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ABSTRACT

The document presents the final report of a summer institute to help high school classroom teachers develop and implement energy education programs. The document is presented in two volumes. Volume I contains workshop objectives, the program schedule, a list of participants, and evaluation results. Major objectives were to familiarize participants with the energy crisis and related policy issues; develop understanding of energy conservation strategies; introduce teachers to energy-related instructional materials; and create linkages between teachers, university scholars, and state energy personnel. Participants were involved in analyzing films, examining instructional materials for bias, writing educational strategies, and touring local energy plants. Topics discussed by conference speakers included state energy agency concerns, perspectives on the energy crisis, basic energy concepts, energy futures, national energy policy, coal resources, alternative energy sources, and ethical issues related to energy. Evaluative comments indicated that a majority of participants enjoyed and learned a great deal about energy from participation in the workshop. Volume II presents suggestions by participants for involving students in energy management programs in schools, a quiz on energy, and a sample audit. Also presented are 36 sample lessons on energy related topics including utility bills, products and energy, energy awareness, and school energy consumption. (DB)

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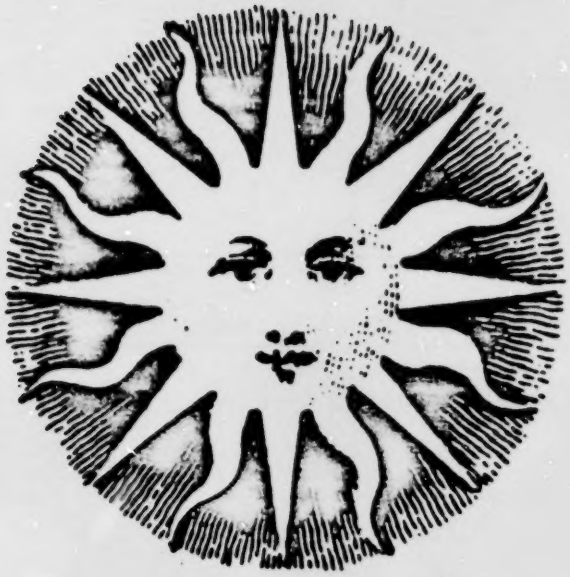

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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ENERGY CONSERVATION EDUCATION LEADERSHIP INSTITUTE

Florida State University
Tallahassee, Florida 32306

Funded by the Faculty Development Program in Energy, United States Department of Energy, Washington, D.C. 20585

Project Director: Rodney F. Allen, Professor, Department of Curriculum and Instruction, Florida State University, Tallahassee, FL 32306 (904) 644-6553

FINAL REPORT

VOLUME I

SO 012 309

U.S. DEPARTMENT OF ENERGY

FACULTY DEVELOPMENT PROGRAM
ATTENDANCE SUMMARY

To be filled out by Project Director. Date July 1st, 1979

College or University Florida State University

Project Title LEADERSHIP INSTITUTE IN ENERGY CONSERVATION EDUCATION

Project Director Rodney F. Allen Contract # 78-02-001
DE-FG05-791R10038

1. Total number of days of the workshop 10
2. Number of class/laboratory/field trip hours of the workshop 40/40/3
3. Number of completed application forms 70
4. Number of participants completing the workshop 30
5. Number of participants provided for by DOE funding 30
6. Number of participants from Colleges or Universities 0
7. Number of participants from Community Colleges 0
8. Number of participants from Technical Institutes 0
9. Number of participants from High Schools (gr. 9-12) 27
10. Number of participants from Jr. High Schools (gr. 7-8) 3
11. Number of participants from Elementary Schools (gr. K-6) 0
12. Number of female participants 15
    Am. Indian 0 Asian 0 Black 3 Hispanic 0 Caucasian 12
13. Number of male participants 15
    Am. Indian 0 Asian 0 Black 3 Hispanic 0 Caucasian 12
14. Estimate the average number of students each participant will have in class during the next academic year 150
15. Number of participants in each of the following disciplines:

    7 a. Biology and Environmental Sciences
    5 b. Chemistry and Physical Sciences
    1 c. Earth Sciences
    3 d. Industrial Arts and Home Economics
    10 e. Social Sciences
    4 f. Other (Home Economics)

* The Institute had ten observers for various periods of time from State agencies, the university, community groups, etc.

DE-FG05-791R10038

This volume was prepared with the support of the U.S. Department of Energy (DOE) Grant Number #78-02-001. However, any opinions, findings, conclusions, or recommendations expressed herein are those of the authors and do not necessarily reflect the views of DOE.

ABSTRACT

Volume I of this final report contains the objectives for the summer faculty development grant, the program format with speakers, a list of participants, summary statements of the evaluation, and the forms used in recruiting and selecting participants.

Secondary school teachers responded well to the initial call for applications. We received many inquiries from educational leaders and teachers across Florida. The director received seventy complete applications. From this pool of applicants 30 were selected to participate, using the criteria written into the original proposal. The teaching fields represented were: home economics, social studies, environmental studies/science, and vocational/technical. The teacher-participants proved to be a lively concerned group, prepared and willing to study, and then to teach about, energy conservation matters in their classes.

On a pre/post energy opinionnaire, developed by Dr. David J. Kuhn, the participants showed significant positive development in energy conservation attitudes. Attitudes concerning government policy and intervention remained mixed from pre to post-test.

On the Department of Energy institute evaluation form, participants' comments were most positive. They perceived the ten speakers as excellent(having made excellent contributions), the institute format and outcomes as meaningful and significant. It was clear that they are personally committed to teaching about energy matters in their classes during the coming academic year.

All participant produced materials has been edited and printed. Each participant has received a copy, and copies will be placed in the Federal ERIC system to make them available to the profession. These materials appear as Volume II of this final report.

INSTITUTE OBJECTIVES

a) To familiarize teachers with the many faceted nature of the energy crisis at the local, State, national, and global community levels, as perceived from a variety of disciplines (economics, physical science, natural science, history, etc.) and from a variety of special interest positions.

b) To increase awareness of the implications of the crisis in terms of policy issues, ethics, personal behavior and life style orientations, directed to the special concerns of energy suppliers, the poor at home and abroad, the aged and the young, etc.

c) To develop an understanding of energy conservation as a strategy in national, State, and local energy plans and in personal life style decisions, along with the kinds of energy conservation approriate to home, school, business, etc.

d) To provide teachers with the conceptual tools to understand the nature of the energy "crisis" and the conservation strategies.

e) To familiarize teachers with a variety of the extant instructional materials available for teaching about energy matters, in general, and energy conservation, in particular (especially DOE sponsored materials available through the Technical Information Center, Oak Ridge, Tennessee).

f) To develop an interest in, and commitment to, teaching about energy matters as an integral part of the teacgers' curricula in home economics, vocational'technical, social studies, environmental studies, and science.

g) To build linkages between a cadre of Florida teachers, on the one hand, and university scholars and State agency personnel, on the other --to support continuing cooperation and sharing of ideas and materials.

MATERIALS DISTRIBUTED AND USED

In the course of the institute teachers receive about fifty pieces of instructional material. An emphasis was placed upon units of the Project for an Energy-Enriched Curriculum, National Science Teachers Association, and the materials produced for DOE by the Lawrence Hall of Science. These units were complemented by various pamphlets, booklets, etc. from diverse sources: TVA, local utilities, insulation manufacturers, the Florida Solar Energy Center, etc.

Three films were used:

ENERGY TO BURN. Boulder, Colorado: Biological Science Curriculum Study. color. sound. 19 minutes.

ENERGY: THE AMERICAN EXPERIENCE. Oak Ridge, Tennessee: Department of Energy Film Library. color. sound. 30 minutes.

RUNNING ON EMPTY: THE FUEL ECONOMY CHALLENGE. Oak Ridge, Tennessee: Department of Energy Film Library. color. sound. 30 minutes.

These films were selected as the most useful and up-to-date from a much greater number reviewed before the Institute began.

During the institute, teachers established criteria and evaluated many of the print materials provided by the staff. These criteria were subject-matter specific and were geared to the teachers' students and classes. Therefore, the criteria and evaluations are not reported here. This assessment process was part of the teachers' preparation for instruction about energy in the fall, 1979.

SKILL DEVELOPMENT

During the institute, teachers learned to do home energy consumption/conservation audits/surveys, classroom energy audits, and initial-level school energy audits. They learned to do this in ways that will facilitate the energy education of their students --as well as conserving energy(and dollars!). DOE materials were used along with Department of Agriculture booklets. Special attention was given to insulation, landscaping, and construction.

Teachers learned to examine materials for bias and inconsistencies. This was part of the materials review process noted above.

Participants were involved in writing their own, brief energy conservation education strategies, submitting their products to peer review and peer teaching.

Selected energy education units and participant produced materials were used in peer teaching. Teachers got constructive feedback on their instructional performance for energy education. These activities on the grounds of the Tallahassee Junior Museum constituted the "laboratory experience" for the institute.

FIELD TRIPS

Rather than bring in additional speakers, teachers went out into the community to learn about energy matters in small

groups --pursuing special concerns. Some visited the education specialist for the State Energy Office, others took a tour of a local power plant (City of Tallahassee Utilities) and interviewed the director. Some toured the Florida A & M University school of architecture low-income housing development facility, while others interviewed State Public Service Commission officers in charge of utility regulation. A sizeable group interviewed the State energy allocation personnel, while a small group discussed environmental regulation and heat recovery with State officials.

The groups reported on their activities on the final day of the institute --sharing insights from their trips and interviews. This proved to be one of the highlights of the program, reducing the number of speakers before the whole group and allowing participants to individualize this portion of the institute endeavor. Our Tallahassee location proved to be an asset in this regard.

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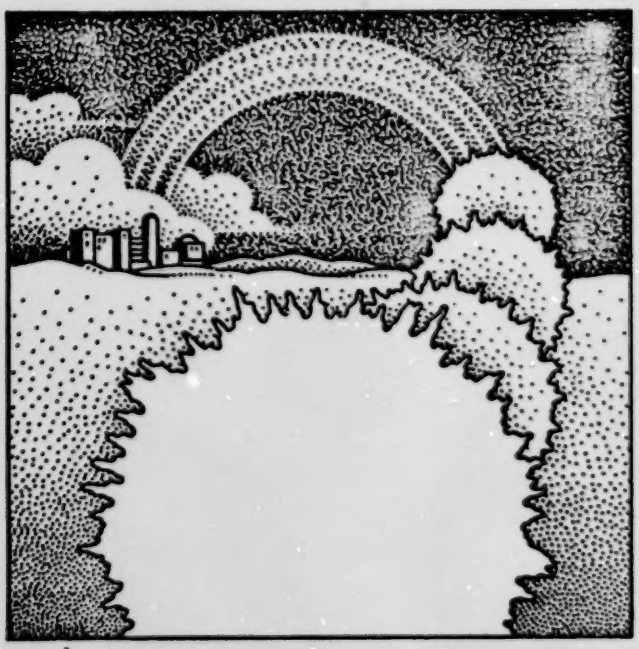

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DOE FACULTY-DEVELOPMENT WORKSHOP
PARTICIPANT EVALUATION FORM

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Institution FLORIDA STATE UNIVERSITY -- SUMMARY FORM June 29, 1979 — 1

Date _____ — 2/3

The purpose of this questionnaire is to obtain your evaluation of the particular workshop which you have attended, and also to help DOE assess the effectiveness of its national program of energy workshops. Please circle the letter or number of your choice.

1. Your *objectives* in attending the workshop were to

a) Increase your knowledge on energy resources and energy problems. *25 persons* — 4

b) Obtain information to use in teaching or energy education projects. *24 persons* — 5

c) Obtain materials for use in teaching or energy education projects. *20 persons* — 6

d) Interact with other teachers. *14 persons* — 7

e) Obtain graduate credit. *12 persons* — 8

f) Other _____ — 9

If more than one of the above, please indicate order of priority.

2. The extent to which you *achieved your objectives* was: — 10

1 Achievement Plus Unexpected Benefits	2 Achievement	3 Partial Achievement	4 Somewhat Unsatisfactory	5 Failure
23 persons	*5 persons*	*2 persons*	*0*	*0*

3. *Content* – the majority of the material covered introduced concepts that increased my knowledge substantially. — 11

1 Strongly Agree	2 Agree Somewhat	3 Neither Agree or Disagree	4 Disagree Somewhat	5 Strongly Disagree
24 persons	*6 persons*	*0*	*0*	*0*

4. *Information Exchange* – the workshop provided opportunity for me to describe my work or learn from other participants. — 12

1 Strongly Agree	2 Agree Somewhat	3 Neither Agree or Disagree	4 Disagree Somewhat	5 Strongly Disagree
19 persons	*10 persons*	*1 person*	*0*	*0*

5. *Usefulness* – the workshop as a whole provided information and experience that was useful. — 13

1 Strongly Agree	2 Agree Somewhat	3 Neither Agree or Disagree	4 Disagree Somewhat	5 Strongly Disagree
26 persons	*4 persons*	*0*	*0*	*0*

6. Where *controversial national issues* were presented, both sides of the issue were given. — 14

1 Strongly Agree	2 Agree Somewhat	3 Neither Agree or Disagree	4 Disagree Somewhat	5 Strongly Disagree
18 persons	*11 persons*	*1 person*	*0*	*0*

7. *The level of presentations* was

1 Far too Advanced for Comprehension	2 Advanced	3 About Appropriate	4 Simplified	5 Far too Simplified
0 persons	*10 persons*	*19 persons*	*1 person*	*0*

8. Give your *overall reaction* to the workshop

1 Extremely Motivating	2 Motivating	3 Neither Tedious nor Stimulating	4 Disappointing	5 Tedious
20 persons	*10 persons*	*0*	*0*	*0*

9. In your opinion, what is the probability of significant *long-term benefits* to your teaching as a result of this workshop?

1 Very High	2 High	3 Medium	4 Low	5 Minimal
15 persons	*14 persons*	*1 person*	*0*	*0*

10. *Format*
Please indicate your reaction to time spent on the following activities according to the scale below. *SEE PAGE 14 FOR SUMMARY*

1 Far too much	2 More than Sufficient	3 About Appropriate	4 Insufficient	5 Far too Little	6 N.A.

a) Lectures by Institute Faculty	1	2	3	4	5	6	18 a
b) Lectures by outside speakers	1	2	3	4	5	6	19 b
c) Development of Curricula Materials	1	2	3	4	5	6	20 c
d) Discussion following lectures	1	2	3	4	5	6	21 d
e) Laboratory Activities	1	2	3	4	5	6	22 e
f) Field trips	1	2	3	4	5	6	23 f
g) Audio/visual materials	1	2	3	4	5	6	24 g
h) Informal discussion and social events	1	2	3	4	5	6	25 h

11. Indicate how you will use the knowledge gained in the workshop (Circle all that apply.)

1. Citation in lectures	26	*23 persons*	26
2. Handouts	27	*26 persons*	27
3. New course	28	*8 persons*	28
4. Research	29	*7 persons*	29
5. Laboratory or demonstrations	30	*13 persons*	30
6. Environmental conservation project	31	*18 persons*	31
7. Other _____	32	*4 persons*	32
8. I do not expect to use the information	33	*0 persons*	33

12. Would you recommend participation in this workshop to a colleague? Yes *30* No *0* — 34

13. At what type of school/college do you teach? — 35

1 College	*0 persons*	3 High	*26 persons*
2 Jr. College or Technical College	*1 person*	4 Jr. High	*1 person*
		5 Other *(middle school)*	*2 persons*

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14. What is your position?

1	Dept. Head	6 persons	4	Curriculum Coordinator	0 persons
2	Teacher/Professor	24 persons	5	Other	0 persons
3	Counselor	0 persons			

15. What is your field? (Circle all that apply.)

General Science	37	0	Home Economics	41	4
Physical Science	38	5	Social Sciences	42	12
Engineering	39	0	Biological Science	43	7
Environmental Education	40	1	Other (specify) (drafting, safety, auto,etc....)	44	5

16. Which grades do you teach? (Circle all that apply.)

(a) 6 or under	0	(d) 9	8	(g) 12	22	(j) adult or continuing education	2
(b) 7	2	(e) 10	20	(h) undergraduate	0		
(c) 8	5	(f) 11	22	(i) graduate	0		

17. How many students in your classrooms that you will address during the coming academic year will be exposed to topics covered in this workshop?

(a) 200+	(b) 200–150	(c) 100–50	(d) less than 50
1 person	17 persons	10 persons	3 persons

Please indicate 1–3 most enjoyable or beneficial activities.

Please indicate 1–3 least enjoyable or beneficial activities.

Suggestions for future workshops and any other comments:
(Use back side if necessary.)

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36

37 41

38 42

39 43

40 44

45 50

46 51

47 52

48 53

49 54

55

Summary for QUESTION #10

	1 Far too Much	2 More than Sufficient	3 About Appro-priate	4 In-Sufficient	5 Far too Little	6 N.A.
A) Lectures (Ins.Faculty)	1	9	20	0	0	0
B) Lectures (Outside Speakers)	1	11	26	1	0	0
C) Dev.Curriculum Material	1	9	15	4	0	1
D) Discussion	1	8	20	1	0	0
E) Laboratory Activities	0	2	13	6	0	9
F) Field Trips	0	4	24	2	0	0
G) A/V Materials	0	5	23	0	0	1
H) Informal Discussion & Social Events	1	7	21	1	0	0

DIRECTOR'S COMMENTS:

As the previous participant evaluation summary indicates, the teachers were vastly satisfied with the Energy Education Credit Institute at Florida State University. These forms, and personal comments, indicate that the speakers and the first week format were excellent. The only reservations expressed involved the heat of that first week in Tallahassee(Monday= 90; Tuesday= 102; Wednesday= 102; Thursday=90; and Friday= 93). The institute was conducted on the grounds of the Tallahassee Junior Museum in a one-room school house, constructed in 1890, and later moved to the grounds. The school house was NOT air conditioned, as we elected NOT to turn on a small (inefficient) window unit. Participants got the feel of how granddaddy's day really was, not how a few romantics would have us believe!

The second week program was more open and less structured. Participants developed lessons (in Volume II of this report), took personally selected field trips (power plant, State Energy Office, State Department of Environmental Regulation, etc.), and interacted on energy issues and educational practices. The participants responded slightly less positively to this programming. In future years, some changes will be made here with greater structure to the writing of materials and getting earlier involvement in the selection of field visits.

The speakers and the Institute staff were more than pleased by the interest and the quality of the teacher-participants. We are very satisfied by the whole program --the best yet of three high school institutes, and the best yet of the five major k-12 energy institutes which we have conducted. Thanks to funding from the State Office of Environmental Education, we will be doing a K-9 energy education workshop in Osceola County, FL(Kissimmee), with the cooperation of one of the summer program participants. Other follow-up programming is under discussion.

Department of Energy
Washington, D.C. 20585

JAN 11 1978

Dr. Rodney F. Allen
Science and Human Affairs
Florida State University
Tallahassee, Florida 32306

Reference: 78-02-001

Dear Dr. Allen:

We are pleased to inform you that your above-referenced proposal to the U. S. Department of Energy's Faculty Development Program has been recommended for funding. You may expect to receive a communication in the next few weeks from the Department's Oak Ridge Operations Office which has responsibility for preparing the formal document of award.

Your proposal was selected from 314 submitted in the FY 1978 program after extensive review. While that review included such aspects as geographic distribution and the relation of the subject matter to Departmental priorities, it also recognized the quality of the proposed project and its staff. We are confident that you will continue to represent the level of excellence which has characterized the Department's educational efforts.

We look forward to working with you in the months ahead, and would bring to your attention the need for careful early planning, including the plans for informing prospective participants of the project. In selecting participants, please consider the Department's commitment to affirmative action goals.

You should also be aware of our plans for a Project Director's meeting to be held here in Washington on March 22-23, 1979. This meeting will be useful to you in planning for the summer program. If for some reason you cannot attend, you are requested to send one of your project's staff.

Dr. Chris K. Kjeldsen is your program contact for the Department of Energy; his telephone number is (202) 252-6482. Please call on him for assistance and/or information on any aspect of this project or the Faculty Development Program. Thank you for your interest in the Department's energy education efforts.

Sincerely,

J. C. Kellett, Jr.
Director
Education Programs Division

Enclosure:
List of Awardees

PLEASE POST FOR TEACHERS

College of Education
Department of Curriculum
and Instruction

The Florida State University
Tallahassee, Florida 32306

FOR IMMEDIATE RELEASE

January 18th, 1979

FIRST ANNOUNCEMENT

The United States Department of Energy has provided the funds for an intensive two-week LEADERSHIP INSTITUTE IN ENERGY CONSERVATION EDUCATION..... The Institute will be conducted by staff from the Environmental Education Project, Florida State University, on the grounds of the Tallahassee Junior Museum. Thirty high school teachers from across the State of Florida will be selected for participation.

The Institute will begin on Monday, June 18th, and run through Friday, June 29th, 1979. Four hours of graduate credit will be available as an option for teacher/participants, successfully completing the program.

Participants will provide their own travel funds, but a modest stipend of $300.00 will be provided to those teacher/participants who successfully complete the program.

Applicants will be sought from high school level teachers in the following fields:

Social Studies | Environmental Studies | Science | Home Economics | Vocational-Technical

The Institute will emphasize CONSERVATION in energy matters. Teacher/Participants will have the opportunity to interact with energy education officals from State and Federal agencies, from private industry, and from public school systems in Florida.

For Additional Information, write:

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ENERGY EDUCATION CREDIT INSTITUTE APPLICATION FORM

I wish to participate in the Energy Conservation Credit Institute to be held at the Tallahassee Junior Museum, June 18-29, 1979:

Applicant's name_____

Home Address _____

_____, _____ zip____

AC( ) _____-_____

High School _____

_____

_____, _____ zip_____

AC ( ) _____-_____

Male ( ) Female ( ) Black ( ) White ( ) (Information needed for Federal Other ( ) _____ funding agency.....)

Subjects Taught 1978-79	Grade Level

Participants in the credit institute agree to attend all sessions, beginning on Monday morning, June 18th, and running on week days through Friday afternoon, June 29th, 1979.

Graduate credit will be available to participants who successfully complete the institute (SSE 5943 Field Internship in Energy Education 4 graduate hours). All fees will be waived except the $2.85 per hour "civic center and building fee" mandated by the State legislature. Thus, the cost of four graduate hours will be $11.40. Graduate credit is an option, and participants will decide whether to register for credit.

Write a two paragraph statement (on the back of this sheet) on how participation in this credit institute will benefit your teaching program.

_____ Applicant's Signature

_____ Principal's Signature

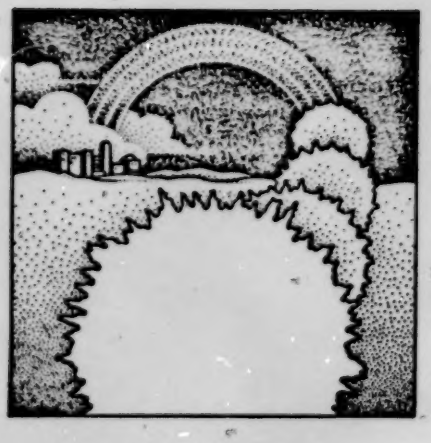
Return the completed form to:
Rodney F. Allen
209 Education Bldg.
Florida State University
Tallahassee. FL 32306

DEADLINE: All applications should be received in Tallahassee by Thursday May 17, 1979. Successful applicants and alternates will be notified by mail on Wednesday, May 23rd, 1979.

SELECTION OF INSTITUTE PARTICIPANTS: The institute director and personnel from the Florida Office of Environmental Education will select participants for this summer credit institute. They will select from high school teachers of science, social studies, vocational-technical education, home economics education, and environmental education, employing the following criteria:

a) support from the teachers' school principals and district administrative staff;
b) distribution so as to involve as many schools in Florida as possible;
c) distribution to attain involvement on a sex, race, and ethnic balance; and
d) distribution to attain a balance in curriculum areas (as noted above).

APPLICANT STATEMENT ON HOW PARTICIPATION WILL IMPACT HIS/HER TEACHING PROGRAM



College of Education
Department of Curriculum
and Instruction

The Florida State University
Tallahassee, Florida 32306

Friday, 18 May 1979

Dear Applicant:

Congratulations! The selection committee for the Energy Education Credit Institute at Florida State University (June 18 - June 29) has chosen you as one of thirty participants for the institute.

To reserve a place, you must *immediately* return the enclosed form indicating your commitment to participate. An envelope is provided.

We have a long, long waiting list for the Institute. If you cannot participate or are no longer interested, please let us know so that another teacher can take your place.

If later in May or June, you find that your plans have changed, call us so that we can select an alternate participant. We want thirty teachers to be able to take full advantage of this opportunity provided by the U.S. Department of Energy.

If you are coming from out of town and do not know anyone in town, arrangements have been made for you to register to stay at Osceola Hall to the west of the campus. Osceola Hall is a privately owned dormitory that is full air conditioned and has many of the amenities of a motel. A brochure outlining the facilities available and showing the floor plan of the suites is attached.

The room rate is $7.28 for a double and $9.36 for a single per night. A room and meals in the cafeteria is $13.00 per day. Participants on the meal plan at Osceola Hall can arrange for the staff to have a brown bag lunch prepared for them since they will be at the Tallahassee Junior Museum during the day.

If you wish to stay at Osceola Hall, please contact Douglas M. Brown, Osceola Hall, 500 Chapel Drive, Tallahassee, Florida 32304. Be sure to tell him you are with the Energy Institute as he as reserved a block of rooms for us. Payment is due upon arrival. They do not take credit cards but will accept your personal check. As it is the summer quarter, Osceola Hall will be for the most part empty. If you have any additional questions concerning this, you can call Doug Brown at (904) 222-5010.

All Energy Institute sessions will be held at the Tallahassee Junior Museum. The Museum is located southwest of Tallahassee, near the airport, on Lake Bradford. If you are using the map on the back of the Osceola Hall brochure, you would go south on Lake Bradford Road from the University and then head west on Route 371 following the signs to the Museum. Dress at the sessions will be informal.

Also enclosed you will find a list of all those participants who have been invited to attend this summer. You may wish to contact one or more who live close to you for the purpose of car pooling.

The last enclosure is a program of activities and events that will transpire during the two weeks. The stipend of $300 will be paid on the last day following completion of the institute. Four hours credit from Florida State University is available if you want it. It is an option that you may or may not take.

Lastly, I am looking forward to working with you during the two weeks we will be together. If you have any questions or concerns, please feel free to contact either me or Randy Felton at (904) 644-6553. Hoping to see you Monday morning, June 18th.

Sincerely,

Rod Allen

RETURN IMMEDIATELY; ADDRESSED ENVELOP PROVIDED

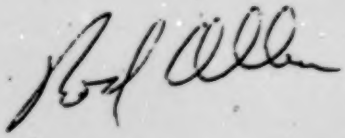
Rodney F. Allen
Randall G. Felton
Dept of Curriculum & Instruction
Florida State University
Tallahassee, FL 32306

I accept the opportunity to participate in the U.S. Department of Energy-sponsored ENERGY EDUCATION CREDIT INSTITUTE at Florida State University, beginning Monday, June 18th, and running through Friday, June 29, 1979.

I have filled out the information blanks below. I understand that my social security number is needed to process my stipend check which will be sent following successful completion of the institute.

If I need housing in Tallahassee, I will make my reservations and be at the Tallahassee Junior Museum on Monday, June 18th, at 8:30AM.

If there are ANY CHANGES in my plans to participate, I will call Rod Allen or Randy Felton IMMEDIATELY at (904) 644-6553. It is understood that there are far more applicants than spaces available. Thus, no-shows cause others to miss out on an opportunity!



Signature _____

Please print:

NAME _____

Home Address: _____

_____ *zip*_____

Home Phone Area Code ( ) ___-_____

SOCIAL SECURITY NUMBER _____-____-_____

College of Education
Department of Curriculum
and Instruction

The Florida State University
Tallahassee, Florida 32306

May 20th, 1979

Dear Applicant:

The thirty participants for the Energy Education Credit Institute at Florida State University, June 18 to June 29, have been selected.

While you were not one of the thirty selected, we have PLACED YOUR NAME ON OUR LIST OF ALTERNATES. In the past at least eight of the alternates have actually attended and participated in the institute! Plans change, people have other obligations after their applications, etc....thus you are still in the running.

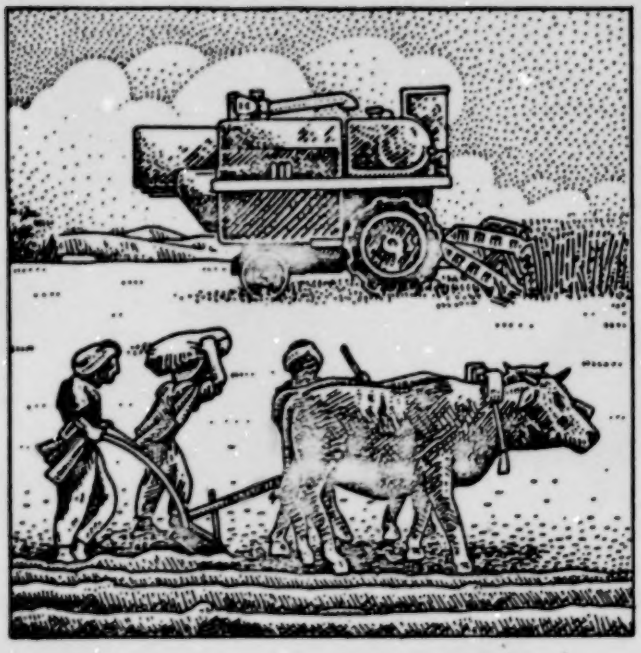
Randy Felton and I have your mailing address and phone number on your original application form. We will contact you the MINUTE an opening becomes available.

You should know that we had a very heavy response to the request for applicants --far more applicants than places. Our selection team faced a difficult task and tried to be as fair as it could, applying the stated criteria.

We appreciate your application and interest in energy education. Hopefully, a place will come open for you!

Rodney F. Allen
Professor

P.S.: If you would like your name removed from the alternate list, please let us know (904)



PROGRAM

ENERGY

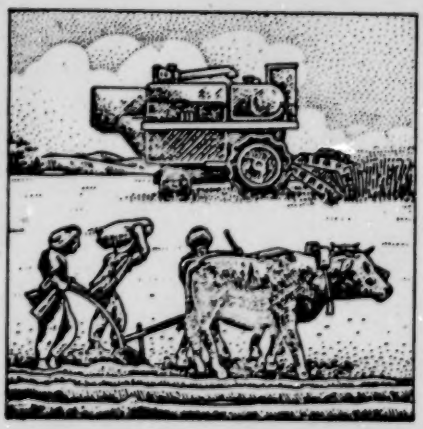
ENERGY CONSERVATION EDUCATION LEADERSHIP INSTITUTE

June 18, 1979 ---June 29, 1979

Tallahassee Junior Museum
3945 Museum Drive
Tallahassee, FL 32304

Rodney F. Allen, Project Director
Department of Curriculum & Instruction
Florida State University
Tallahassee, FL 32306
(904) 644-6553

"In selecting individuals for participation and otherwise in the administration of this program, Florida State University will not discriminate on the grounds of the race, creed, sex, color, or national origin of any applicant."



ENERGY

MONDAY, June 18th

8:00AM Coffee*

Welcome and Institute Overview **
Rod Allen, Florida State University

State Agency Concerns:
Rosalyn B. Tillis, State Energy Office
C. Richard Tillis, Office of Environmental Education

9:30AM The Energy Crisis in Perspective
John M. Fowler, National Science Teachers Association

11:15 Energy to Burn: A Film
Discussion

12:00 LUNCH (Brown Bag)

12:45PM Simulating Our Energy Future
A. Henry J. Hagedoorn, University of Central Florida
Discussion

2:15PM Small Group Interaction (Instructional Unit)

3:00PM Adjournment

TUESDAY, June 19th

8:00AM Coffee

8:15AM Basic Energy Concepts in Systems
Arthur R. Marshall, Environmentalist

Discussion

11:00 President Carter's National Energy Plan
Rod Allen

12:00 LUNCH (Brown Bag)

12:45PM Small Group Interaction (Instructional Unit)

2:30PM Adjournment

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* To conserve energy, bring your own reuseable coffee mug! We will provide coffee, but no plastic or paper cups.

** To conserve energy, the Institute will be conducted in open, non-air conditioned facilities. Dress casually!

WEDNESDAY, June 20th

8:00AM Coffee

8:15AM Energy, Needs and Desires: Comments on the Future

George DeVore, Department of Geology, FSU

Gregory Choppin, Department of Chemistry, FSU

Interaction with the Speakers

10:45AM Small Group Activity (Instructional Unit)

12:00 LUNCH (Brown Bag)

12:45PM Coal Resources: An Energy Future?
Jim Hudson, Tampa Electric

Discussion

3:00PM Adjournment

THURSDAY, June 21st

8:00AM Coffee

8:15AM Alternative Energy Sources: Practical Possibilities
Gerald Ventre, Florida Solar Energy Center

Discussion

11:00AM Energy Conservation Mini-Kits
Tom Baird, Pasco (FL) Energy Management Center
Hands-on Experiences

12:30 LUNCH (Brown Bag)

Building Design & Management
Jack Stefany, Architect, Tampa

2:30PM Adjournment

FRIDAY, June 22nd

8:00AM Coffee

8:15AM Ethical Issues in Energy Use and Conservation
Roger Shinn, Union Theological Seminary, New York

Discussion -- Some "practical situations"

12:00 LUNCH (Brown Bag)

12:45PM Lifestyle Considerations: Activities
Rod Allen & Randall G. Felton

2:00PM Energy Conservation Strategies: Small Groups

3:00PM Adjournment

MONDAY, June 25th

8:00AM Coffee

8:15AM Household Energy Conservation Surveys: Activities
--Junior Museum Farmhouse
--Main Museum Buildings

11:30AM Group Reports

12:15 LUNCH (Brown Bag)

1:00PM Energy Error Cards: Writing Teams

2:30PM Sharing

3:00PM Adjournment

TUESDAY, June 26th

8:00AM Coffee

8:15AM Energy Error Cards: Writing Teams

11:30AM Sharing

12:15 LUNCH (Brown Bag)

1:00PM Critical Reviews of Energy Materials: Small Groups
Establish Criteria
Reviews of Extant Materials

2:30PM Adjournment

WEDNESDAY, June 27th

8:00AM Coffee

8:15AM Reporting Out on Critical Reviews

9:30AM Preparation for Peer Teaching: Small Groups

12:00 LUNCH (Brown Bag)

12:45PM Team Teaching of Simple Activities

3:00PM Adjournment

THURSDAY, June 28th

8:00AM Coffee

8:15AM Team Teaching (con'd)

12:00 LUNCH (Brown Bag)

12:45PM Teacher Team Interviews with Energy Officials:
--State Energy Office personnel
--State Public Service Commission personnel
--Division of Consumer Services personnel
--local utility(electric) personnel
--Florida Petroleum Council personnel
--etc. (based upon personal interest)

FRIDAY, June 29th

8:00AM Coffee

8:15AM Reporting Out on Team Interviews

Discussion

11:00AM Staff/Participant Sharing of Materials Designed During the Institute

12:30 LUNCH (Brown Bag)

1:15PM Institute Evaluation

2:30PM Recommendations and Conclusion

All participant materials will be typed and printed for distribution in a follow-up mailing to all participants.

Participants successfully completing the Institute will receive a $300.00 stipend.

College of Education
Department of Curriculum
and Instruction

The Florida State University
Tallahassee, Florida 32306

JUNE 29th, 1979

TO WHOM IT MAY CONCERN:

The person named above has completed an Energy Education Credit Institute at Florida State University. The course began on Monday, June 18, 1979, and ran until 1:00PM, Friday, June 29th, 1979. This person successfully fulfilled the requirements for the course and has earned four graduate quarter hours of credit. Due to the mechanics of the University's registrar's office, grades will not appear on a transcript until the end of the summer, 1979, academic quarter, so this letter is provided as evidence that the person has successfully completed the course as of 1:00PM, June 29th.

The energy education course was multidisciplinary (see attached program). It involved presentations by physical and natural scientists, by ethicists, by professional engineers and architects, and by an economist. Students studied materials related to the energy situation of the global community from each of these areas.

As a multidisciplinary course, the course prefix used was a "social studies education" prefix. But teachers who participated were drawn from science, home economics, vocational-technical, and social studies fields. For science teachers, the course should be seen as a science course with heavy physical science content (and the application of that content to the instruction of students, 7-12). For home economics, the emphasis in the second week of sessions was on energy conservation strategies. For social studies teachers, the emphasis was upon the history, economics, and values inherent in the use of energy and in energy policy decisions. While the prefix for the course was a social studies prefix, the course title better reflects the multidisciplinary nature of the program: FIELD LABORATORY INTERNSHIP IN ENERGY CONSERVATION EDUCATION (4 graduate quarter hours credit).

Sincerely,

Rodney F. Allen
Professor
209 Education Bldg.
(904) 644-6553

ENERGY CONSERVATION EDUCATION LEADERSHIP INSTITUTE

Florida State University, Tallahassee
Florida 32306

Funded by the Faculty Development Program in Energy, United States Department of Energy, Washington, D.C. 20585

Project Director: Rodney F. Allen, Professor, Department of Curriculum and Instruction, Florida State University, Tallahassee, FL 32306 (904) 644-6553

FINAL REPORT

VOLUME II

NOTE: The activities in this volume are selections from the many activities teachers developed during the US DOE Faculty Development Program in Tallahassee, June 18-29, 1979. They are provided to the profession --not as lessons for adoption --but for adaptation, to spur the creativity of other teachers who want to do energy education.

The opinions, arguments, perceptions, and sentiments included herein represent only those of the lesson authors and not any position by the Florida State University or the U.S. Department of Energy.

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Involving Students in Energy Management Programs in Schools.....4

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Sample Energy Audit: A Museum Building.....8

Using Energy Content to Develop Basic Skills: Some Sample Lessons.....9

Energy Error Cards.....29

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INVOLVING STUDENTS IN ENERGY MANAGEMENT PROGRAMS IN SCHOOLS

It was agreed that three important facets of energy education are: 1) LEARNING about energy, 2) HOW to conserve energy, and 3) OWNERSHIP of the school (a sense of community) wherein one feels responsibile and willing to conserve for the good of others and for one's long-term self-interest.

Our group was relative pessimistic about the possibilities for sustained energy management by students, given the decline in a sense of community among Americans in general and Floridians, in particular. Student do not feel a sense of ownership of the schools. They see that schools function paternalistically to take care of them, or to serve them -- but they are not THEIR schools. Hence the utility bills are not THEIR bills.

In this conntection there are three ways to deal with persons: AUTHORITY(POWER), CONTRACTUAL, or COVENANT. The authority mode involves laying down the rules and enforcing them with power. One may get others to comply, but one does not secure volunteer cooperation beyond the arm of power. In the contractual mode all of the obligations of each party are spelled out in detail. The effect is to restrict one's obligations and duties. The mentality is not full involvement as a person, but to play a carefully defined ROLE. Such a disposition does not engenger the feelings necessary for curbing self-interest for the common good. The covenant mode is based upon the sentiment of gift. I am going to school thanks to the gift of my teachers, citizens, etc. Through the giving of a gift, I pick up obligations to others who have given it. Since we are all interdependent and involved in giving gifts--the mutuality or reciprocity of community life is understood. In this sense, energy conservation and management makes sense.

More of a sense of ownership, involvement, and covenant makes student action to ard energy conservation. But these factors are not the central characterists of public school operation in our time. Thus, effective energy management (and participation) by students truly involves a thrust against the self-absorbtion of our times and contemporary culture.

Meanwhile, several specific suggestions were made by participating teachers:

1. Teachers might select a team of students to serve as energy monitors each week, reporting on the energy used (and misused) in the school.

2. Students with teachers and administrators might monitor school utilities(units consumed and costs) as in the United States Department of Energy's Workbook for School Energy Audits. This monitoring might also involve plans for energy saving and participatory decision-making by

all on the use of school budget dollars conserved!

3. Students, teachers, administrators, and community members might work together on ad hoc teams to devise means to conserve energy (e.g., turn off water coolers, reduce peak load, etc.). This also might involve encouraging bicycle riding, car pooling, etc.

4. The ad hoc teams might consider increasing student and community use of the school building as a way of conserving energy in the community. School facility recreation use, lectures and community educational programming, and community group programming might well save long trips to facilities farther way --and give an added benefit of increasing public involvement and identification with the school and its program.

5. Item #4 might well involve year-round school use (summer programs, etc.), community summer day care programs, combining school-recreation league and park programming on the school campus. Community service programs could use the campus in other ways --a community compost pile, street fairs, etc.

6. Use meters to demonstrate to faculty, staff, and students the electric consumption of various school and household appliances (e.g., ditto machine, electric typewriter, hair dryer, copy machine, football field floodlights, etc.). Seek their recommendations.

7. Use the rest of this page to add your own WAYS to learn about energy, learn how to conserve energy, and develop a sense of ownership of the school.....

RUNNING ON EMPTY: A QUIZ

1. _____ What would be the cost of driving your car four miles to pick up a gallon of milk?
   (a) 25¢
   (b) 35¢
   (c) 50¢
   (d) $1.

2. _____ How long should you let your car warm up before driving it each day?
   (a) 30 seconds
   (b) one minute
   (c) three minutes
   (d) five minutes

3. _____ You are the first one at a red stoplight. When the light changes to green, the proper gas saving way to start is ...
   (a) slow acceleration
   (b) fast acceleration
   (c) jackrabbit acceleration

4. _____ What happens, in terms of time and gas consumption, when you manuver in and out of traffic, speeding up when possible and slowing down when necessary?
   (a) You save time but not gas.
   (b) You save both time and gas.
   (c) You lose time and gas.
   (d) No change.

5. _____ How far could you drive on the amount of gas your car would use while idling for ten minutes?
   (a) 2 miles
   (b) 3 miles
   (c) 4 miles
   (d) 5 miles

6. _____ How much fuel will you save driving your car 55 miles per hour as compared to driving 70 miles per hour?
   (a) 5%
   (b) 10%
   (c) 20%
   (d) 30%

7. _____ You are approaching a hill. For conservation of fuel, when would it be best to accelerate?
   (a) a short distance before you reach the hill
   (b) at the base of the hill
   (c) on the hill as the car begins to slow down

8. _____ Assume you are driving a car equipped with an air conditioner at a constant speed of 55 miles per hour. Which would be the most energy (gas saving) efficient?
   (a) Drive with the windows down.
   (b) Drive with the air conditioner on.

9. _____ How much fuel can you save if you keep your tires at recommended pressure rather than ten pounds under that pressure?
   (a) 2%
   (b) 3%
   (c) 4%
   (d) 5%

10. _____ Is it true to say that the higher the octane the higher the gas mileage?
   (a) yes
   (b) no

11. _____ About how much money could you save by car pooling each year?
   (a) $100 - $ 200
   (b) $200 - $ 300
   (c) $300 - $1000
   (d) $1000- $2000

12. _____ How much money would you save each year (in gas) by buying the best car for gas mileage in any class you choose to buy (i.e. subcompact, compact, midsize, or fullsize)?
   (a) $ 50
   (b) $ 250
   (c) $ 500
   (d) $1000

ANSWERS:

1. (d)	4. (c)	7. (a)	10. (b)
2. (a)	5. (d)	8. (a)	11. (c)
3. (b)	6. (c)	9. (d)	12. (c)

This activity is drawn from a film(RUNNING ON EMPTY) which is recommended to teachers and their students. It is available from the U.S. Department of Energy Film Library, Box 62, Oak Ridge, Tennessee. 16mm. color. sound. 24 minutes.

SAMPLE ENERGY AUDIT: A MUSEUM BUILDING

Using the United States Department of Energy's School Energy Audit Workbook and one hour of Institute time, the participants made the following energy conservation suggestions regarding one of the Tallahassee Junior Museum's exhibit buildings.

Good Points:

1. The building is located in a shaded area, so the sun does not beat down upon the sidewalls or roof in the summer.

2. The design is beautiful, with outdoor walkways and good roof overhang.

3. The building has a basement and high ceiling in the exhibit area.

Deficiencies and Suggestions:

1. The air conditioner is set too low. The building is cold. The main function of air conditioning is humidity control and that could be accomplished more efficiently in the exhibit area and the basement with dehumidifiers and ceiling fans.

2. The windows are single glazed. If air conditioning is continued, the glass should be double glazed(thermal pane) with a double entry door system (vestibule) to provide an air lock.

3. The window and door areas need to be caulked as an air and waether seal.

4. The builing's basement is improperly sealed (poor construction) and thus water enters the basement as moisture. This adds to the air conditioning/dehumidifier strain.

5. If heating is required, the ceiling should be dropped in the exhibit area.

6. The exhibit area uses flood lights which need cooling (2300 watts per hour). A different lighting system, not using incandescent bulbs, could save on cooling costs.

7. Glass jalousies in doors leak air. Sliding glass doors have huge spaces and are loose. Heating and cooling are lost and this also creates a humidity control problem.

8. Air conditioning ducts should be reworked. Heat outlets should be 6" from the floor,while the cooling outlets should remain high on the wall.

USING ENERGY CONTENT TO DEVELOP BASIC SKILLS: SOME EXAMPLES

Sample Lesson 1: What is Energy?

Purpose: to define energy; kinetic and potential

Skill: prediction via the Cloze Procedure

Procedure: The Cloze Procedure is an activity which helps students predict appropriate word choices and improves comprehension. Every 5th word is deleted. Students fill in an appropriate word in the blank. Accept any logical synonym.

What is energy? The first step in trying to define energy is to set up two categories. Energy in the form _____ motion, heat, or light _____ called kinetic energy. Energy _____ is stored in food, _____, the nucleus of atoms _____ batteries is called potential _____. Kinetic energy is energy _____ the move. Potential energy _____ stored energy and it _____ in this form that _____ dig it from mines _____ pump it from wells. To use energy, it must be in the kinetic form.

Answers: of, is, that, gasoline, and, energy, on, is, is, we, and

Reading from Energy, Engines, and the Industrial Revolution. U.S. Department of Energy, National Science Teachers Assn, EDM 1032, 1977.

Sample Lesson 2: Energy Terms

Purpose: to familarize students with terms used in energy conservation

Skill: vocabulary development

Procedure: Students should use the words below to fill in the sentences:

electrical energy	oil shale	wind energy	nuclear power
solar power	coal	geothermal power	

WORD

1. An abundant, clean renewable source of energy _____

   Needs solar collectors to store energy for non-sunlight hours

   Major difficulty seems to be how to store energy

2. Obtained by wind-powered propellers connected to generators which produce electricity _____

Can be used to pump water into storage for later conversion to hydro-electric power

Not always a depenable source of energy

3. Uses heat produced within a burner reactor containing core of fuel composed primarily of Uranium

   Energy released by fission _____

   Generates intense heat and uses steam to drive generators

4. Fossil fuel

   Most abundant source of fuel

   Found in ground

   Crushed to powder and decomposed by heat at high pressure _____

5. Sedimentary rock containing bonds of hydro-carbon

   Large amounts of water are required in process of extraction _____

   Must be mined

6. Hot water or steam produced when underground water comes in contact with heated rocks

   Heat may reach 700 degrees Fahrenheit _____

   Steam is used to produce electricity

7. Secondary source of energy

   Made when oil, natural gas or coal are burned _____

   Nuclear power may be used to drive turbines

Sample Lesson 3: Energy Terms in Context

Purpose: to learn energy terms using context clues

Skill: using context clues to develop vocabulary

Procedure: Students should use the words below to fill in the blanks:

energy fuel engine conserve WORD

1. a. You expend _____ with every movement. _____
   b. It takes a lot of _____ to run a mile.

c. Protein is a quick source of _____.
d. The world has a limited source of _____ to supply our needs.

2. a. When you use resources wisely, you _____ them. _____
b. We must learn new ways to _____ energy.
c. _____ your money now and you will have more to spend later.
d. Before a big race, runners must _____ their energy.

3. a. A car needs _____ to run. _____
b. One fossil _____ is oil.
c. _____ is needed to make things work.
d. Food is the _____ for our bodies.

4. a. A machine which changes one form of energy into mechanical energy is called an _____. _____
b. It is important to keep the _____ of a car in good working order.
c. A fire _____ is red and has a siren.
d. An _____ must have fuel to run.

Sample Lesson 4: Utility Bills

Purpose: to familiarize students with how to read and compare utility bills.

Skill: reading a bill, computation, drawing conclusions

Procedure: Study the utility bill below and answer the questions.

CITY OF TALLAHASSEE, CITY HALL TALLAHASSEE, FLA. 32304
UTILITIES DEPARTMENT

CURRENT BILLING DATE 05/15/79
ACCOUNT NUMBER 205-12203
SERVICE AT 103 Easy Street
METERS READ 05/03/79 DAYS SERVICE 29

FUEL ADJUSTMENT $ .0123 -/KWH
FIRM GAS ADJUSTMENT /CCF
INCREASE IN FUEL COST SINCE OCTOBER 1, 1973 $.0053/KWH

METER READING	UNITS USED	SERVICE	CLASS	AMOUNT
7663	594	E	15	29.08
FUEL ADJUSTMENT				7.31-
3168	136	W	01	7.55
		SC		10.10
		GC		5.00
SERVICE TOTAL				44.42
		TX		2.48
TOTAL SERVICE & TAX				46.90

CURRENT BILL 05/15/79 46.90
AFTER 06/15/79 CURRENT BILL PAST DUE
PRESENT BALANCE 46.90

USAR, ENERGINE
103 EASY STREET
TALLAHASSEE, FLA.
32303

RETAIN THIS BILL FOR YOUR RECORD
RETURN PAYMENT CARD WITH REMITTANCE

1. Tell what the following letters mean on the utility bill:
   E. W, SC, GC, TX
2. In what units are each utility measured?
   a. electricity
   b. gas
   c. water
3. Locate the meter for each utility in your home. Keep track of how much you use for one week.
4. What is fuel adjustment?
5. Compare the utility bills in your home over the year.
   a. What month is most expensive? Why?
   b. What month is least expensive? Why?
   c. Is heating or air conditioning more expensive? Why?
   d. Are their different forms of heating and air conditioning units that are more energy efficient? Which ones are they and how do they work?
6. Who gets the money for utility use? What do they do with it?

Sample Lesson 5: Products and Energy

Purpose: to analyze products in terms of their energy consumption

Skill: drawing conclusions, making value judgements

Procedure: With a minimum of advance class discussion, have students select ads of five or more energy using pieces of merchandise. Cut out and paste on paper. They will then read and answer the following questions regarding their selections.

1. Which piece of merchandise of those you selected would use the most energy per hour? Which would use the most per day?
2. Which merchandise would you need the most?
3. Which merchandise would you need the least?
4. Which merchandise could all civilized people live without?
5. Which piece of merchandise do you think makes the most money for its makers?
6. Which piece of merchandise do you think gives employment to the most people in its manufacture or use?
7. Which uses up most of our resources in its manufacturing?

Follow-up: class discussion of selections of each person and answers to the above questions.

Sample Lesson 6: How do I save energy? Let me count the ways...

Purpose: to reduce energy consumption of students

Skill: computation

Procedure:

1. Calculate the number of energy units you used for the week. Make sure you have included all things that require energy. Include lighting, heating or cooling, operation of refrigerator and other appliances.
2. Keep a diary for a second week with an eye toward reducing your energy consumption at least 10%.

3. Continue for a third week and try to conserve more and more. By what percentage can you cut your energy usage and not affect your lifestyle?

Sample Lesson 7: How energy conscious are students?

Purpose: to decrease energy usage by increased awareness

Skill: computation, drawing conclusions, making value judgements

Procedure:

1. Keep an energy diary for one week (see lesson 6).
2. Compare your diary with others in your class. How is your lifestyle different from others? What things are you willing to give up that others can not (and visa versa)?
3. What conflicts are involved in deciding which (if any) energy consuming activities to give up? (comfort vs energy)

Sample Lesson 8: Miles per gallon

Purpose: to compare different modes of transportation in terms of their energy consumption

Skill: computation, forming a generalization, making inferences

Procedure: Using the chart below, figure out the most cost efficient method to use on a field trip to Marianna Caverns. The round trip mileage is 113 miles. There will be 50 students and 3 teachers on the field trip.

Type of Urban Transportation	Fuel Mileage (Average) MPG=miles per gallon
Automobile	18 MPG
Van	16 MPG
Bus	3.3 MPG
Commuter Train	.1 MPG
DC Jet	.25 MPG

1. What is the best (most cost efficient) way to the class to go.
2. Which mode of transportation is the most convenient and comfortable?
3. Which is most practical?
4. Write a sentence using two or more of the words below: convenient energy cost gas choice

Sample Lesson 9: Energy Awareness

Purpose: becoming aware of one simple operation which will conserve energy

Skill: car maintainence, drawing conclusions

Procedure: Compare a dirty air cleaner with a clean one

1. Locate hood latch release.
2. Raise hood.
3. Remove wing nut from air cleaner.

4. Lift cover from air cleaner and remove replaceable part of air cleaner.
5. Inspect air cleaner to determine air flow by holding up to a light. If light penetrates air cleaner, it is useable.
6. If no light is seen, bounce air cleaner gently on a flat surface and recheck. If still no light can be seen, replace.

Drawing conclusions:

a. How does a dirty air filter affect the most efficient performance of a car?
b. Does the same principle apply to other filters, such as the one on air conditioner units?

Sample Lesson 10: Transportation

Purpose: to be able to read and interpret a simple table

Skill: drawing conclusions from a table

Procedure: Answer the following questions:

TYPES OF URBAN TRANSPORTATION	FUEL MILEAGE (AVERAGE)
Automobile	18 MPG
Van	16 MPG
Bus	3.3 MPG
Commuter Train	.1 MPG
DC Jet	.25 MPG

1. Which uses more gas per mile?
2. Assume that you can carpool or take a bus on a field trip thirty miles away. Which would be the most efficient way for your class to go to the field trip? Use table two in your calculations.

Table 2			
Car	4 people	18 MPG	.28 gallons per person
Bus	40 people	3.3 MPG	.20 gallons per person

3. What other factors would influence your choice?

Sample Lesson 11: Your Dream Machine

Purpose: to compare different kinds of cars in terms of energy consumption

Skill: computation, comparing and contrasting, making decisions

Procedure: Choose the car of your dreams. Compute your gas mileage and cost for a trip of 175 miles.

MODEL	MPG	MODEL	MPG
Civic: CVCC	44	Trans Am	17
Datsun 200 SX	26	Cutlass Supreme	18

Rabbit	34	Cougar	16
Opel	27	Bonneville	17
Mustang II	26	Eldorado	14
Datsun 280 Z	21	Continental Mark V	13
LTD II	17	Grand Prix	17
GTO	17	Chevy Van	18
Ford Van	16	Dodge Van	16

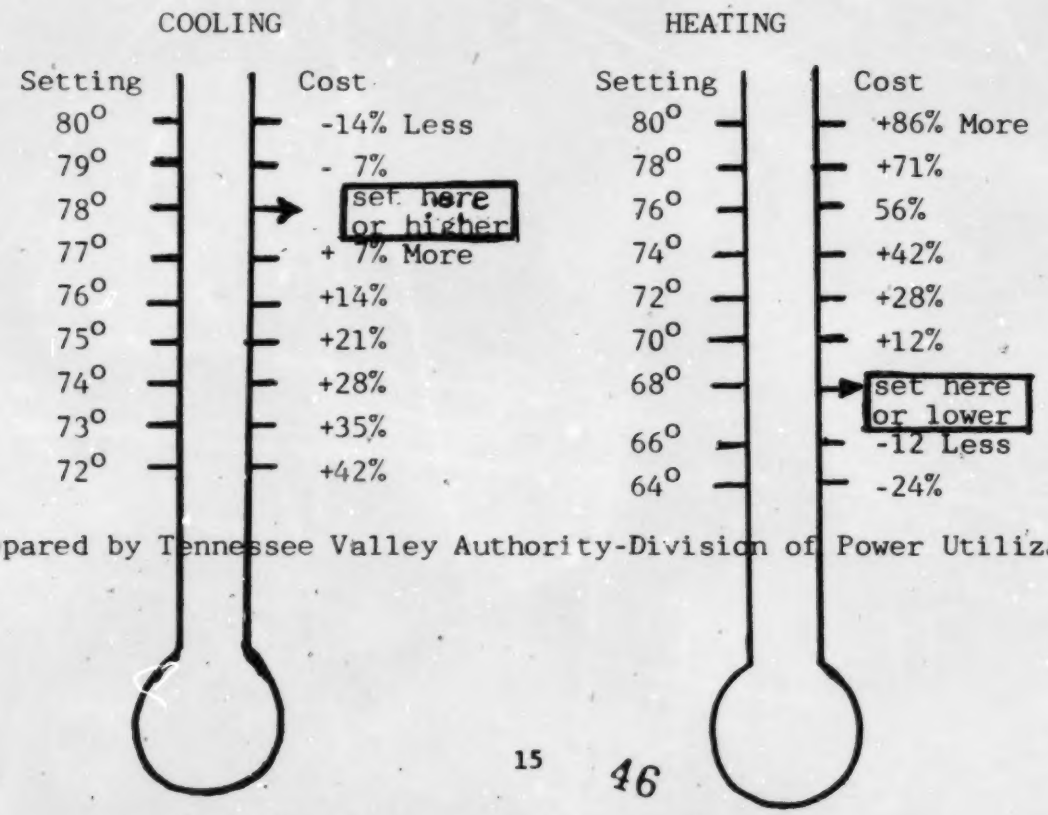
1. Which vehicle gets the most miles per gallon?
2. Which vehicle uses the most fuel for a 20 mile trip.
3. Which uses the least amount of fuel per person?
4. If the 1000 people who rode on the commuter train, drove a car instead, how much additional fuel would be used?
5. How much fuel is saved by having 40 people ride a bus instead of using 20 cars with two people in each car?
6. Which car is the smallest/biggest?
7. What vehicle would you want to drive? Why?
8. After comparing these methods of transportation, what conclusion could you make about the use of energy and what choices must be made in making energy decisions?

Sample Lesson 12: Space Heating and Cooling

Purpose: determining heating and cooling cost

Skill: drawing conclusions from a graph

Procedure: The utility company estimates that the heating and cooling cost should average $50 per month. Use the following chart to compute the cost of each family's cost for space comfort.



Prepared by Tennessee Valley Authority-Division of Power Utilization

	Jones	O'Conner	Smith	Perry
Jan	72°	80°	80°	68°
Mar	72°	80°	80°	68°
May	72°	80°	74°	79°
July	72°	80°	72°	79°
Sept	72°	80°	72°	79°
Nov	72°	80°	78°	66°

1. Compute the cost of each family's cost for space comfort.
2. Which families are saving money and energy?
3. Which families are spending the most money?
4. Which family is the most energy wise?
5. Which family is the most like your family?

Sample Lesson 13: Electricity Meters

Purpose: to determine the number of kilowatthours used for various types of appliances and measure the amount of electricity used in their home.

Skill: reading a meter, computation

Procedure:

1. Locate the electricity meter for your home.
2. While you are watching the dial, have a friend turn on different appliances (such as hair dryer, TV, radio, fan, air conditionder/heater, etc.).
3. Note which appliances use the most/least electricity.
4. Compare use of the following in energy usage:
   a. crockpot and surface range
   b. toaster oven and range and oven
5. Think of other appliances that do the same job and determine which is most energy efficient to use.
6. Note the kilowatt hourse everyday for one week.
   a. How much electricity does your family use every day?
   b. Which days does your family use the most/least electricity?
   c. Compare charts with a friend. What are the reasons for any differences you find?

Sample Lesson 14: Neighborhood Energy Consumption

Purpose: to compare energy consumption of different households

Skill: comparing and contrasting, interpreting and constructing questionnaires

Procedure:

1. Discuss ways to conserve energy in the home. Students then divide into groups of four or five and prepare a "Home Energy Consumption Survey" for use in a neighborhood project. The results of the survey will be tabulated by the groups and all of the information will be combined to present a more

complete picture of home energy consumtpion in the neighborhood.
2. Students will work in their groups to construct a bar graph which will graphically represent the information.
3. The class will then discuss their findings and analyze various methods which might be employed to conserve energy in homes within the neighborhood.

Sample Lesson 15: School Energy Consumption

Purpose: to find ways to make the school more energy efficient

Skill: conducting a survey

Procedure:

1. Read and discuss information on conservation of energy in institutions. Consider the following tips:
   a. leaky faucets
   b. lights left on
   c. north/south windows
   d. types of lighting
   e. wind direction
   f. maintainence of equipment
   g. thermostat settings
   h. cleaning of filters
   i. insulation
   j. heat pumps vs other systems
   k. weatherstripping on doors and windows
2. Have students make and fill out a checklist of things to look for at school.
3. Compile results and make recommendations to the proper authorities about how to conserve energy at school. In the analysis, include:
   a. cost of change
   b. feasibility of change
   c. plan to educate people (students, teachers, administrators) in bringing about change

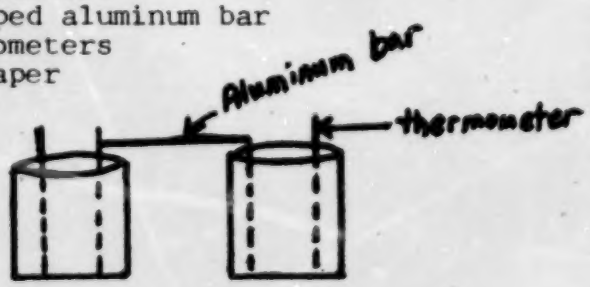
Sample Lesson 16: Energy Flow

Purpose: to teach "loss" of energy in a system

Skill: making and interpreting graphs, computation

Materials:

2 calorimeters
1 U shaped aluminum bar
2 thermometers
graph paper



Procedure: Place room temperature (22°C) water in calorimeter B. Place boiling water (100° C) in A. Check temperature of A and B at zero time, when pouring boiling water in A and each minute thereafter for 10 minutes. After 10 minutes, graph the temperature of each calorimeter.

Discussion:

1. Did B gain as much energy as A gave up?
2. How many degrees temperature did A give up after 10 minutes? (answer - 100°-60°C = 40°C)
3. How many degrees temperature did B gain in 10 minutes? (answer - 37°C - 22°C = 15°C)
4. How many degrees of temperature were lost to the system after 10 minutes? (answer - 40° - 15° = 25°C)
5. What happened to the "lost" 25°C of energy? (answer - heat was lost to a) calorimeter, b) aluminum bar and c) some fingers that touched the conductor (aluminum bar) during the experiment).

Sample Lesson 17: Insulation effectiveness

Purpose: to determine the effectiveness of the insulation by measuring temperature change

Skill: measurement, graphing

Procedure:

1. Wrap coffee cans with different R-values of insulation.
2. Place ice inside (300 g)
3. Measure temperature outside insulation every 5 minutes.
4. Plot temperature using line graph.
5. Determine which insulation is most effective.

Sample Lesson 18: Solar Collectors

Purpose: to determine which color is most efficient as a solar collector

Skill: observation, measurement, graphing, drawing conclusions

Materials:

soup cans - same size
paint of different colors, flats and glossy
thermometers
water
paper
clock

Procedure: Students will work in groups of two. Paint one can a particular color, add 50 ml of water, place in the sun for 45 minutes. Record the temperature change for each 5 minute interval.

Discussion questions:

1. Graph the temperature change in degrees vs time.
2. Which color seems to absorb the most heat?
3. What do you think would have resulted from a wider, more shallow can?

4. Compare the white can to other colored cans.
5. How does the black can compare to the other colored cans?
6. How can you apply what you have learned from this experiment to solor collectors used for home heating?

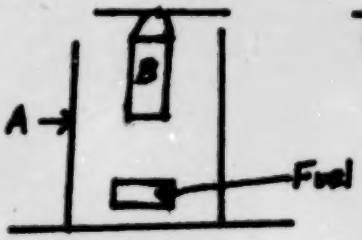
Sample Lesson 19: Fuels and Calories

Purpose: to determine relative amounts of energy in calories per gram from an assortment of fuels

Skill: measurement, drawing conclusions

Materials:
tin can calorimeters
assorted fuels such as: candle (wax), kerosene in can with wick, benzene, charcoal lighter, sterno
thermometers (celsius)
matches

Large can (A) for chimney. Both ends open. Holes cut on both sides. Small juice can (B) on hangar for water.



Tin Can Calorimeter

Procedure:

1. Teacher discusses heat terminology
   --calorie - as heat needed to raise 1 gram of water 1^{o} C
   --differentiate between heat and temperature
   --calculation: calories = (Mass water heated) X (temperature difference of water) X $\left(\frac{1 \text{ cal}}{g\ ^{o}C}\right)$
2. Students then set up cans as per diagram. Secure fuel assigned to them. Light the wick and collect heat in can of water.
3. Data to be collected:
   mass of water in can by weighing or by volume (water is 1 g per mole)
   initial temperature of water
   final temperature of water
   mass of fuel before burning
   mass of fuel after burning
4. Discussion
   a. How many calories (total) went into the water?
   b. How many calories per gram of fuel burned?
   c. Do you feel your results were lower or higher than those to be obtained with more sophisticated equipment?
   d. From your results and those of your classmates, which is the best fuel?

Sample Lesson 20: Photovoltaic Cells

Purpose: looking at photovoltaic cells and the problems involved with its use for homes in the near future

Skill: computation, drawing conclusions

Procedure:

1. Begin with solar cells and small motors that individual students may use. In a closed school room the sun can be an incandesent lamp. After using the motors, the cell can be used on a meter to read voltage and amperage.
2. By holding the cell in their hands, students will realize that heat is given off during the use of the cell and if the meters are good enough, as the heat increases, amperage should drop.
3. Discuss the photoelectric effect; perhaps by talking about electric eyes for cameras, garage door openers or in chemistry as light shinning on a metal causing an electron to be ejected. (Explanation - light of different intensities will produce this effect with different metals.)

Sample Lesson 21: Brownian Movement

Purpose: Brownian movement will begin the lesson on convection currents and how they may be used in cooling rooms, heating water and transfering pollutants.

Skill: observation, drawing conclusions

Procedure:

1. With room closed (no air conditioning on and no fans blowing) and using a small amount of H_2S (hydrogen sulfide - rotten eggs) or ammonia (NH_3) in one corner of the room, estimate the amount of time it takes for each student to smell it as it moves around the room due to Brownian movement (velocity of momentum due to molecular contact). So that we have movement without adding energy, increase the temperature of the room and note increase in speed of molecules.
2. a. With a coffee can, candle and match show convection from bottom of can out through top.

   b. Apply this process with color in warm water with cold overlay.
   c. Brownian movement can also be demonstrated with iodine crystals in alcohol.

Sample Lesson 22: Saving Fabric

Purpose: Placement of a commercial pattern for an article of clothing can be wasteful of fabric if cutting guide accompaning pattern is followed.

Skill: pattern cutting, comparing and contrasting

Procedure:

1. Compare fabric required for placing pattern with tissue paper borders left on and with border removed before pattern placement.

2. Apply basic general rules for pattern placement and compare size and shape of fabric scraps left and/or the yardage that can be saved when purchasing fabric.
3. List ways to use fabric scraps for 1) accessories, 2) small children's clothing 3) household items, etc.

Sample Lesson 23: Dishwashing

Purpose: Since dishwashing is a daily practice in homes and food service institutions, it does have a direct impact on energy conservation. Students will compare hand and mechanical washing methods.

Skill: comparing and contrasting

Procedure:

1. Compare energy consumption for hand-washing and maching dishwashing considering amount of water, temperature of water and sanitizing agents for same amount and kind of dishes/utensils.
2. Compare time and human energy required for hand or machine washing for same kinds and amounts of dishes/utensils.
3. Students may want to use the dishmachine handbook to acquire information about the amount of water for machines. Students may need to measure actual water by gallon containers for washing and rinsing by hand. Use the temperature gauge on the hot water heater for both to measure temperature. Use standard measuring devices for the measure of sanitizing agents.

Sample Lesson 24: Glass Areas at Home

Purpose: Glass windows and doors can be both energy wasters and savers. The awareness of physical qualities of materials available for shades, drapes, blinds, etc. can aid in energy conservation.

Skill: comparing and contrasting

Procedure:

1. Students should obtain swatch books from local stores which includes the prices in order to compare different drapes, blinds, etc.
2. Students then compare the insulative efficiency of a variety of drapery and shade fabrics.
3. Students then explore ways to save the cost of providing insulative lining to existing window treatments.

Sample Lesson 25: Personal Care

Purpose: Grooming is the first visual contact with others. It reflects your self-esteem and consideration for others. Wise use of grooming aides contributes to energy conservation.

Skill: comparing and contrasting

Procedure:

1. Compare energy consumption of a 6 inch tub bath vs a 3 minute shower bath.
2. List grooming activities other than personal hygiene which conserve energy.

Sample Lesson 26: Changes in Energy

Purpose: to compare different forms of energy and it's uses in three different generations

Skill: questionnaire administration and analyses, comparing and contrasting, drawing conclusions

Procedure: Have students interview as many people as possible in the three different age groups, compile the results, draw conclusions and discuss the results.

Question: Have you ever used the following "appliance"?

	Age 10-20	Age 21-50	Age 51+
1. electric stove			
2. wood burning stove			
3. fan			
4. dishwasher			
5. TV			
6. radio			
7. electric toothbrush			
8. kerosene lamp			
9. record player			
10. fireplace			
11. central air & heat unit			
12. weed eater			
13. power lawn mower			
14. water pic			
15. iron			

Sample Lesson 27: Energy Attitudes

Purpose: to compare attitudes toward energy in three different generations

Skill: comparing and contrasting, drawing conclusions, questionnaire administration and analyses

Procedure: Have students interview as many people as possible in the three different age groups, compile the results, draw conclusions and discuss the results. Students may want to add questions of their own.

	Age 10-20	Age 21-50	Age 51+
1. How do you feel about the energy crisis? 2. Has there always been an energy crisis? 3. What is the cause of the crisis today? 4. What is the best solution to the problem? 5. What made you first aware of the energy crisis?			

Sample Lesson 28: Who Gets the Energy?

Purpose: to provide a vehicle for getting students to think about energy rationing

Skill: value judgements, decision making

Procedure: In our desire to solve the energy crisis - a shortage and perhaps irreplaceable use of certain sources of energy, it may be necessary to make certain decisions to curtail or even cut off the supply of an energy source to certain people.

1. You are the Secretary of the Department of Energy. The President has given you the task of determining who gets the supply of energy. Below is a list of groups of people. Rank them in order of priority as to who would be cut off from energy first to last. Be prepared to defend your answer.

1. Farmers	___	9. churches	___
2. Energy sources that manufacture technological aids for foreign countries (countries which supply us with oil)	___	10. middle-uppper class neighborhoods	___
		11. migrant workers	___
		12. WASPS	___
		13. governmental buildings	___
3. persons on life-support systems	___	14. shopping centers	___
4. anyone over 72 years of age	___	15. grocery stores	___
5. mentally-retarded persons	___		
6. poor in major cities	___		
7. schools			
8. recreations areas (football fields, etc.)	___		

2. How did you justify the cutting off of certain groups from energy?
   a. If there are groups that were left off this list and you feel they should be considered, who are they?
   b. Rather that using the President's edict of cutting supply. would a massive conservation plan be easier or more effective to implement? Why or why not?

Sample Lesson 29: Island Energy

Purpose: to discover modes of energy in the environment and how to utilize them

Skill: decision making, value judgement

Procedure: You have been stranded on an island in the middle of the Pacific Ocean. There is no hope for your rescue in the immediate future. You must set up your own community. Unfortunately, nothing from the wreckage was saved. Mangoes, coconuts and other fruits are plentiful.

1. What energy sources do you have available to you? (wind, water, etc.)
2. How would you use these resources? Design some "machines" to help make your life more comfortable.

Sample Lesson 30: An Energy Efficient Community

Purpose: to sensitize student to energy efficient living

Skill: value judgements, decision making, map making

Procedure:

1. Discuss with students different forms of energy and what is needed to live. The idea that certain "comfort vs conservation" decisions must be made should be discussed.
2. Have students work in groups and design their own community. This can be a communal or single family dwelling community. Energy decisions should be made and designs drawn. An actual layout of the community should be drawn.

Sample Lesson 31: Environment vs Energy

Purpose: to get students thinking about the cost of energy to the environment

Skill: cartoon interpretation, making value judgements

Procedure: Study the cartoon below and answer the questions.

Sacrificial altar (*Lane, Newspap Enterprise Association*)

1. State the problem presented in the cartoon.
2. What is the attitude of the cartoonists to the problem?
3. Do you agree or disagree with this attitude?
4. Write a letter to the editor about the issue.

Sample Lesson 32: Ocean Pollution and Energy

Purpose: to sensitize students to the problem of transporting oil in the ocean

Skill: cause and effect, sequencing, finding the main idea, noting details

Procedure: Read the following article and answer the questions.

Ocean Pollution

The need to transport huge quantities of oil across the seas has led to some dramatic oil spills; and yet, 85-90% of oil pollution from vessels comes not from such accidents but from operational discharges, such as tank-cleaning, ballasting, and dry-docking.

A 1954 international convention prohibits such discharges within 50 miles of land, and limits it at sea. Some amendments to this convention—to enter into force in January 1978—provide further tightening of discharge limits. But the United States has been urging universal adoption of a more recent instrument—a 1973 convention—which not only reinforces these provisions but requires structural innovations—notably "segregated ballast"—in large new tankers.

The point about "segregated ballast" is this: After unloading their oil, tankers have customarily filled some of their oil tanks with water, to serve as ballast on the return trip. Then, on approaching the port where they were to take on new oil, they have washed out these tanks, pumping the oily water overboard. The 1973 convention will require not only that this oily water be kept aboard—in separate or "segregated" tanks (which incidentally reduces the ship's oil-carrying capacity by some 10-30%)—but that oil-loading ports have facilities for disposing of it on land.

In addition, President Carter in March 1977 recommended to Congress a package of both domestic and international measures. These included strong U.S. support for tighter international standards for tanker construction, operation, and inspection; and many of these proposed measures would eventually apply to foreign tankers calling at U.S. ports if the international community does not adopt sufficiently strict standards in the meantime. Among these would be a requirement for segregated ballast tanks on many more tankers (e.g., on vessels of 20,000 deadweight tons or larger) than called for by the 1973 international convention (which requires these only on vessels of 70,000 deadweight tons or above).

from The United States and World Energy, 1977, p. 18.

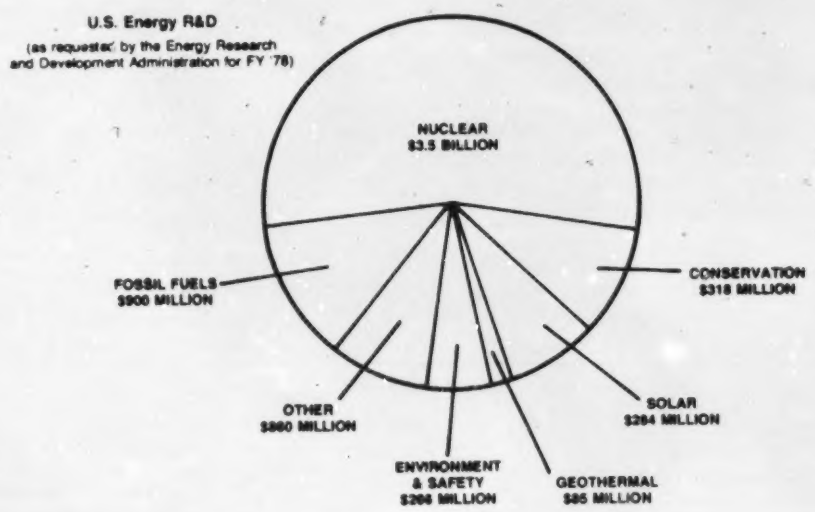
1. CAUSE AND EFFECT: Finish the sentences below:
   a. Because of the need to transport oil, _____.
   b. Because of oil spills, the 1954 convention _____.
   c. Because oily water was being pumped overboard, _____.
2. SEQUENCING: Arrange the following sentences in the proper order:
   a. President Carter recommended a package of domestic and international measures.
   b. International convention prohibits oil discharges within 50 miles of land.
   c. Convention requires "segregated ballast".
3. MAIN IDEA
   a. What is the main idea of this selection?
   b. List 3 details which support this main idea.
4. VALUE JUDGEMENTS
   a. Do you agree with the decisions of these conventions? Write a paragraph stating why your support or do not support them. Cite the facts in the article.

Sample Lesson 33: U.S. Energy Research and Development

Purpose: to sensitize students to priorities of the U.S. Government in energy research and development

Skill: drawing conclusions and making inferences from a graph

Procedure: Given the pie graph below, students will answer the following questions:



from The United States and World Energy, 1977, p. 37.

1. What are the priorities of the U.S. Government in energy research and development?

2. Why do you think this may be a priority?
3. If you could control the "pursestrings", how would you "slice the pie"?

Sample Lesson 34: Energy in the News

Purpose: to increase awareness of energy related matters in the newspaper and magazines

Skill: reading and interpreting news articles

Procedure: Students read the news article below and answer the following questions:

7 COUNTRIES VOW TO LIMIT OIL IMPORTS

TOKYO - After two days of complex negotiations, leaders of the world's industrial democracies Friday agreed to put limits on, and generally freeze, their imports of oil up to 1985.

The United States, after long and difficult talks with European nations undertook to keep imports within a ceiling of 8.5 million barrels of oil a day.- equivalent to the record import reached in 1977 - until the mid 1980s.

The American decision was a concession to European nations led by West Germany, which called for long term controls on oil imports. But the European side in turn agreed in principle on country-by-country limits on their imports in 1979 and 1980, in accordance with American wishes.

The compromise between the industrial powers of the West came just after an announcement by the Organization of Petroleum Exporting Countries that members of that oil cartel would raise official crude oil prices from $14.55 a barrel to between $18 and $23.50 a barrel.

That rise in prices, which President Carter told reporters meant "a 60 percent increase in oil prices in the last six months," threatened to push the world into recession, accelerate inflation, and cut employment.

from Tallahassee Democrat
June 30, 1979

1. How do decisions made by one country concerning energy affect another?
2. What is OPEC and what does it do?
3. How do OPEC decisions concerning energy consumption affect you?
4. Find articles concerning energy related issues from newspapers and magazines. Share these articles with the class explaining the issues, people and organizations involved.

Sample Lesson 35: Oil Supply and Demand

Purpose: to construct bar graphs showing the supply of oil and constrast it with the demand for oil in countries around the world.

Skill: constructing a graph

Procedure: Use the figures presented below to construct a bar graph.

DEMAND	
Rest of World	20%
Japan	7%
Western Europe	20%
South America	12%
Caribbean	5%
Canada	8%
U.S.A.	28%

SUPPLY	
Rest of World	57%
Japan	1%
Western Europe	5%
South America	5%
Caribbean	10%
Canada	10%
U.S.A.	12%

Sample Lesson 36: Prove or Disprove

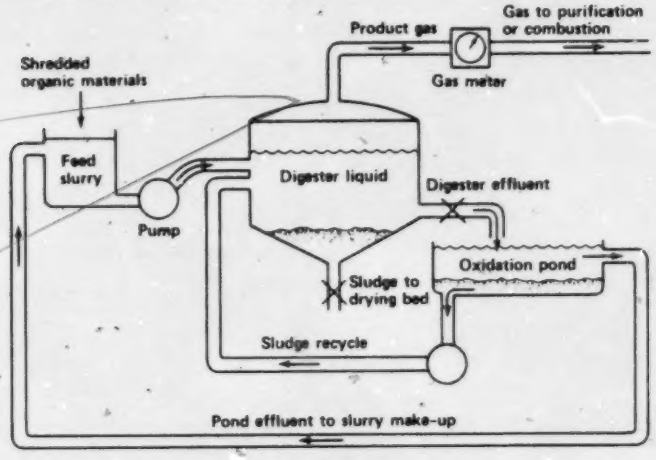
Purpose: to help students select a position on the issues related to the energy crisis and find supporting evidence

Skill: comprehension, finding evidence, writing

Procedure: Students should write a paragraph supporting or not supporting the following statements:

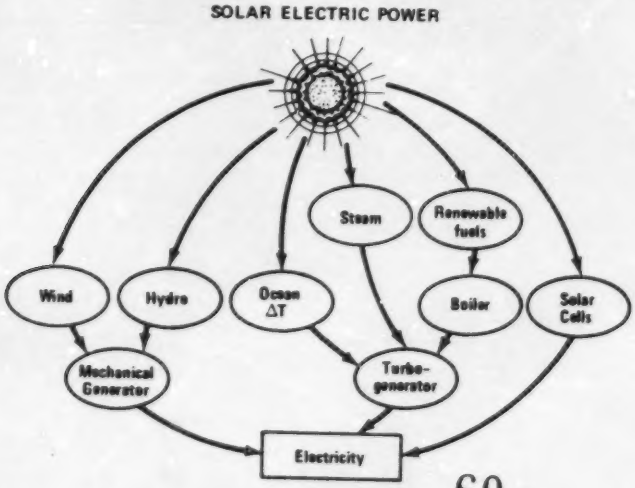
1. The energy crisis is contrived by the oil companies to raise prices.
2. Oil companies should be nationalized so that prices could be controlled.
3. Rationing of all energy should be implemented so everyone gets their share.

ENERGY ERROR: Veula Johnson had lived near farms and cattle feed lots all of her life. She heard that B & W Cattle Company was generating its own electricity, using manure. "That," she said, "sounds like a lot of bull." After all, she reasoned, you can't burn manure, you just plow it into soil to grow crops. Veula's son, Isaiah, argued that they not only make electricity from manure, but they also plowed it into the ground!"How could that be?" Use the chart below to ease Veula Johnson's perplexity.



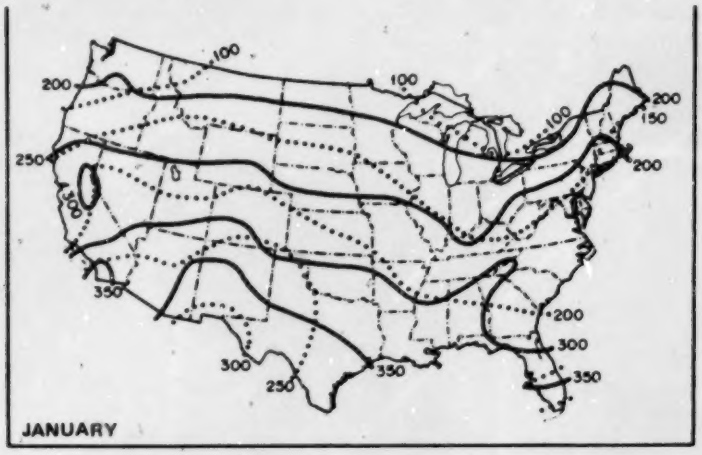
Concept of a unit for continuous conversion of organic material to methane by anaerobic fermentation (without oxygen).

ENERGY ERROR: Veula's friend, Ed Lewis, lived in a big city. He had installed a solar hot water heater on his home and he saved money. But, he thought, "That's about the only thing we can do with solar. The sun's rays are tough to collect! If only we could make electricity using solar energy." Ed's neighbor argued that he had a very narrow view of "solar energy" (just the direct use of the sun's rays). Examine the following diagram to get the drift of Ed's neighbor's thinking.

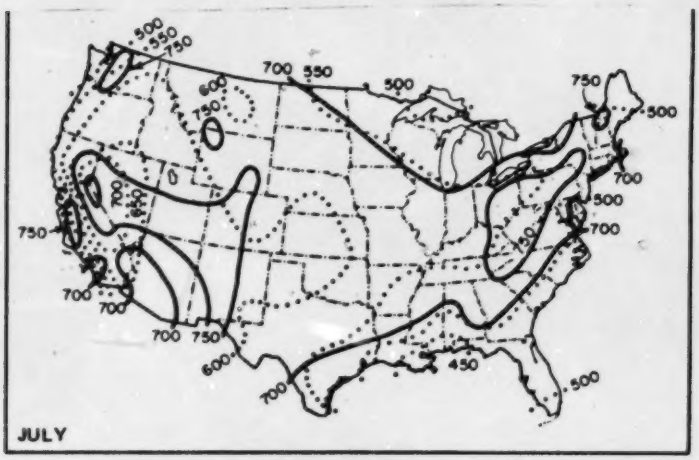


60

ENERGY ERROR: Mel Felton was really into solar power. He studied everything he could get his hands on. Now he was building solar devices for his home. Mel decided to build a new house at the point in the United States where solar energy would be most effective. He chose Southern Delaware. Use the maps below to check out Mel's choice.

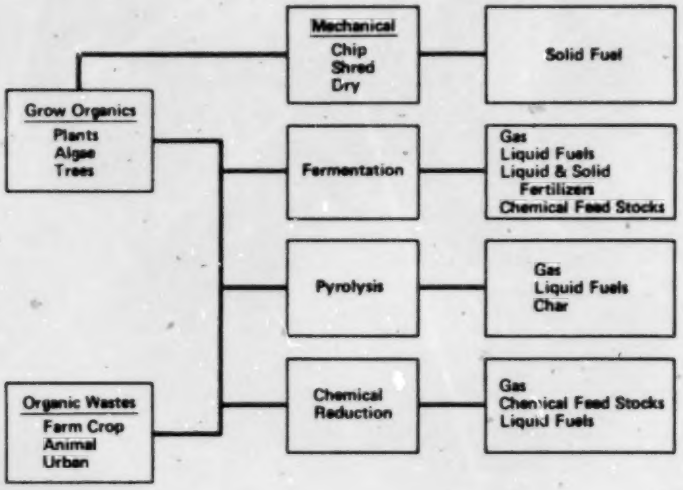


Lines of equal total daily solar energy at the ground on cloudless days (solid lines) and on days of average cloudiness (dotted lines) in January and July. Units are calories per square centimeter per



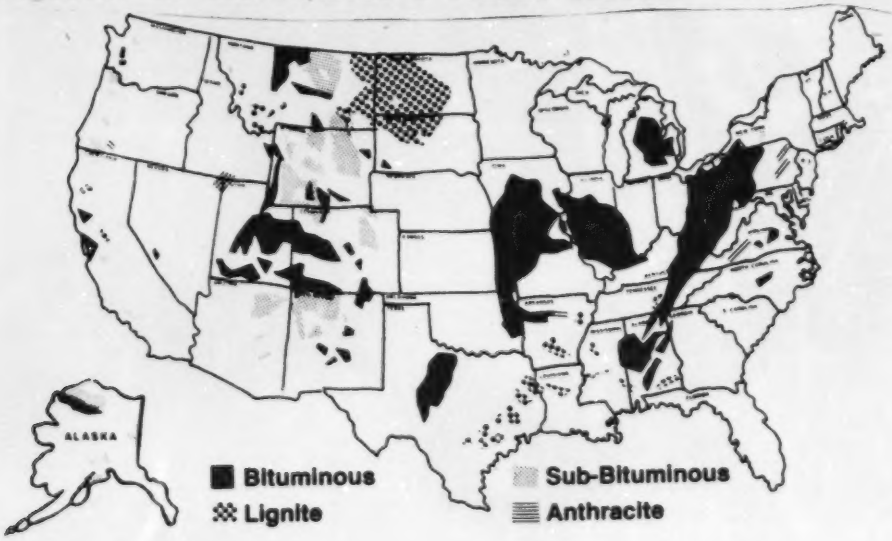
day. The annual average for the United States is 377, corresponding to 13% of the original energy of the sun. Expressed in American units, this is 58 Btu per square foot per hour.

ENERGY ERROR: Tracy argued that solar energy was nice and clean. But, she said,"It would never amount to much because it was so diffuse and low-grade. Even good solar collectors were not too efficient. We cannot upgrade(or concentrate) solar power to make fuels, to run even local plants and industries." Admiral Felton knew that was not true, but he did not have his facts. Use the following diagram to give the Admiral some "facts."



Various methods of producing different kinds of fuels from solar energy.

ENERGY ERROR: Senator Zebulon Smith (Democrat, Florida) wants to save his energy-deficient State by mining lignite in the Dakotas, transporting it by rail car to Florida, and generating electricity. Learn what you can about lignite. Is the Senator's scheme sound?



ENERGY ERROR: The Walter family wants to do their part in Energy Conservation by changing to a more efficient home heating system. Therefore, they decided to buy a smaller electric furnace since it would use electricity. Was this an efficient decision?

(Hint: A small heater will work harder to produce the heat needed to heat the home. What other alternatives would have been better?)

ENERGY ERROR: Bill Thomas, a carpenter by trade, decided several years ago to build his own home as a means of controlling coast and insuring quality. It was also his decision to make an energy efficient home. Since he found flourescent tubes to be very large and bright, he installed regular 75-watt bulbs in his modern indirect lighting system. Was this an energy efficient decision?

ENERGY ERROR: Keith and Ann, concerned about the high cost of energy, are having the walls in their new home insulated with 3½" of fiberglass. Is this a good move?

(Hint: Definitely, but what about the ceiling, floors, and windows?)

ENERGY ERROR: Frita is a magnificent housekeeper. She also has a deep concern about energy conservation. For example, after each meal, she does her dishes by hand in order to conserve on the hot water that the dishwasher would use? Isn't this commendable?

(Hint: Not necessarily. When you have a full load of dishes, an electric dishwasher uses less hot water than by doing them by hand.)

ENERGY ERROR: Pete and JoAnn, after years of waiting and planning, are finally going to have their dream house on two wooded acres of land in the country. After having the land cleared, they left it up to the contractor as to where to put the house and as to what energy efficient features he thought should be included. Would you say that Pete and JoAnn made a good move?

(Hint: If they were truly serious about energy efficiency in the new construction, why did they clear the land of the trees?)

ENERGY ERROR: According to the map below, Florida has two petroleum producing areas and Georgia does not have any. Therefore, we can properly conclude that, in terms of energy supply, Florida is much better off than Georgia. Correct?

ENERGY ERROR: Tom and Jerri are designing and building their own home. Worried about the costs and shortage of energy, they included a firplace with a big hearth and firebox. Was that an efficient decision for a house built in North Florida?

(Hint: A fireplace has a heating efficiency of 10%; 90% of the heat goes up the chimney. Newer design wood stoves are 60% or so efficient.) How might Tom and Jerri improve upon the efficiency of their fireplace(without switching to a wood stove?

ENERGY ERROR: Shirley and Carlos have just bought a home for a big black wood stove. That was, in their eyes, one of the best features--it will save on home heating bills. It is October and they need to buy wood. Dealers have offered them: 1) split, dry wood at 40 dollars a cord; 2) dry, unsplit wood at 39 dollars a cord; or 3) some nice big logs, unsplit, which just came out of the woods for 30 dollars a cord. Which should they buy and why?

ENERGY ERROR: Larry is proud of his new, wood buring stove. No longer will he have to depend on oil or coal. He can simply in the woods outside of town to obtain fuel. It is now November and Larry goes into the woods and cuts a huge hickory tree for his winter heat. What error has Larry made?

(Hint: Dry wood puts out 25% more BTUs than green wood)

ENERGY ERROR: George and Mary have a nice little wood stove in the kitchen for winter heat. George just came home with a load of slash pine chunks to use in the stove. He says that pine wood smells soooo great. Mary says it is dangerous to burn. Who is making an error? How?

(Hint: What chemicals might collect in the chimney from a pine fire?)

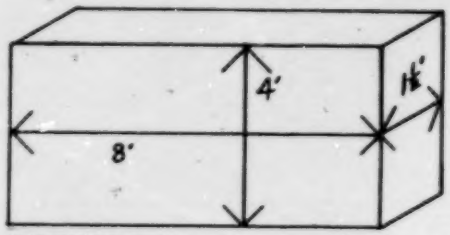
ENERGY ERROR: Sarah and Alphonse discovered that red maple firewood was less expensive than hickory and white oak. Therefore, being dollar-wise shoppers, they bought red maple firewood for heating their home. Did they make a wise choice or an energy error? The red maple was $2 a cord less than the hickory and oak.

Available Heat per Air Dry Cord[1] and Its Equivalent Value Compared to Coal

Species	Available Heat in One Standard Cord-Million Btu's	Equivalent Value With Stoker Coal At $60/Ton Delivered
Hickory	24.6	67.20
White Oak	22.7	62.40
Beech	21.8	59.40
Red Oak	21.3	58.20
Southern Pine	20.5	55.80
Red Maple	18.6	51.00
Elm	17.2	46.80

[1]Source: Table 38, Section 14, Page 74. FORESTRY HANDBOOK. One cord of 80 cubic feet solid wood at 20 percent moisture.

ENERGY ERROR: Tracy had an opportunity to buy a cord of hickory and white oak for $30, or she could get a rick of oak and hickory firewood for $22.00. She chose to but the cord. Judging on the price (not her needs), did TRacy make the right choice? Why?



A RICK OF WOOD

ENERGY ERROR: John decided to save heating dollars by burning wood rather than coal. He bought two ricks of red oak for $45.00. He could have bought a ton of coal for $60.00, or a cord of red oak for $50.00. Assume that the wood was dry. Was his choice the best of the three? Why? Why not?

ENERGY ERROR: Superintendent McWilliams is alarmed by rising school utility bills. He has worked with parents, teachers, and students to conserve energy. They have all co-operated. Now, McWilliams wants to save natural gas by heating the school with wood. The community has little suitable wood, so it will be trucked in from woodlots a hundred miles away. Is this wise? Why? Why not?

If you and McWilliams opt for wood, how would you burn it? In a central plant? Or in room stoves?

ENERGY ERROR: In building a home in sunny Florida, a builder chose to use the California style, Brown home. He added many energy saving features and insulation beyond the state energy office's recommendations. Was this wise?

(Hint: Check the color of the home.)

ENERGY ERROR: Randy and Renee, because of the energy crisis, feel very guilty about taking a vacation this year. They decided that during the trip they would do everything possibly to reduce their fuel and energy consumption. Prior to leaving, Randy had the car tuned and the tires checked for proper inflation. On the road, they kept the car at a constant 55 miles per hour and drove with the windows down to conserve fuel rather than using the air conditioner. They even left their canoe home because of the wind resistance it created on the roof of the car. Should this delightful couple be cited as energy efficient examples for the rest of the country?

(Hint: For the most part yes. However, it should be added that at speeds of 55 and above, you save fuel by using the air conditioner because of the wind resistance created by open windows).

ENERGY ERROR: Frankie and Johnny were determined to cut down on the amount of heating oil they had consummed last winter. At a cost of over $ 4,000, they had a contractor build an all-brick fireplace in their den, the largest room in the house. Since Johhny worked at a lumber mill and could get all his firewood free, he assumed that he could better heat his house, save money, and "do something" about the energy crisis. Was his assesment correct?

(Hint: Fireplaces produce on 10% heat for the wood burned. Most of the hot air goes up the chimney. Their money might have been better spent on a Franklin stove which produces 60% heat for the wood burned.)

If you are considering buying a dishwasher, look for a model with air-power and/or overnight dry settings. These features automatically turn off the dishwasher after the rinse cycle. This can save up to 10 percent of your total dishwashing energy costs.

Keep the lint screen on your clothes dryer clean. Check it regularly. Lint impedes the flow of air in the dryer and requires the machine to use more energy.

Keep the outside exhaust of your clothes dryer clean. Check it regularly. A clogged exhaust lengthens the drying time and increases the amount of energy used.

On very humid days, set your air-conditioner fan speed at low. You'll get less cooling, but more comfort because more moisture will be removed from the air. And you'll save some energy.

***

Electric lights generate heat. Reduce lighting levels in your home whenever you can -- and save on both lighting and cooling costs.

***

Have you cleaned or replaced your air-conditioner filters recently? Clogged filters make the units work overtime -- a waste of energy and money. The filters should be checked at least once a month.

***

Clean the heating elements and reflectors on your stove. They'll reflect the heat better, shorten cooking time, and lower your gas or electricity costs.

***

Remember -- good insulation keeps cooling cost down. If your attic and walls aren't properly insulated, this may be a good time to make the improvements. As a bonus, you'll be all set for winter. And you could reduce the load on your heating and cooling equipment by 20 to 30 percent for years to come.

***

Save energy by using the old-fashioned clothesline this summer. And clothes dried out-of-doors often seem cleaner and fresher than those taken from a dryer.

Consider using a fan to spread the cool air from your room air conditioner farther -- but be sure the unit is powerful enough to cool the additional space. The fan, of course, uses much less power than an additional air conditioner would.

***

Don't forget, a car air conditioner reduces fuel economy by as much as two and one-half miles per gallon of gasoline. Turn it off unless you really need it.

***

ENERGY ADMONITIONS:

A modification on energy errors cards is to use the pithy admonitions from energy agencies. This page and the two following pages offer many of them.

Cut out one for each student. Get them to figure out if the admonition makes sense. And, if so, why. Ask them to indicate if they would follow the admonition and why.

Buy products that are designed to last. By using more durable products you can help save the energy needed to manufacture new goods and materials. And even if the purchase price is a little higher, the odds are you'll save money in the long run.

***

During hot, humid weather frost generally builds up quickly on freezer walls, so you should defrost more often this time of year. If the frost is thicker than one-quarter of an inch, it decreases the efficiency of the freezer, takes up usable space, and increases operating costs.

***

Do you know how much gasoline your car's engine consumes when it's idling? One cup every six minutes! So get in the gas-saving habit -- turn the engine off if you have to wait a minute or more.

***

Turn off your window air-conditioners when you leave a room for several hours -- and save on cooling costs. You'll use less energy cooling the room down later than if you had left the unit running.

***

Double the energy-efficiency of your double boiler by cooking foods in the top and bottom at the same time. You'll save the gas or electricity you would have used for a second burner -- and you'll reduce the heat generated by the stove.

***

When you use your automatic dishwasher, turn it off after the final rinse, prop the door open a little, and let the dishes air dry. You'll save about one-third of the energy the dishwasher uses, and more than 30 percent in operating costs.

***

Are the ducts in your air-conditioning system properly insulated? Check them out, especially the ducts that pass through the attic or other uncooled spaces. Improperly insulated ducts could cost you up to 9 percent extra in cooling costs.

***

Are you planning to redecorate for Spring and Summer? Remember that light-colored draperies and curtains don't just look cooler in warm weather. They reflect sun and heat outward -- and help reduce the load on your air conditioning system.

• • •

If you have a small lawn, why not use a push-type lawn mower this year. You'll save the energy that a power mower would use, and get in some healthy exercise as well.

• • •

If you're watching television and there is a lamp with a three way switch in the room, always turn the lamp to the lowest lighting level. You'll reduce the glare, and save electricity.

• • •

Do you cook with electricity? Get in the habit of turning the burners off several minutes before the cooking time is up. The heating element will stay hot long enough to finish the cooking for you -- without using more electricity. And your electricity bill will reflect your energy savings.

• • •

During the next few months you can save a lot of energy and money. Turn off your home heating system as soon as you can, and wait until very warm weather comes to use your air conditioning. Let the sun shine in for warmth, and open the windows to cool your home.

• • •

Consider planting deciduous trees on the south and west sides of your home. As they grow, they'll help shield your home from the hot summer sun and reduce the demand on your air conditioning equipment. You'll save energy, and lower your utility costs, for years to come.

• • •

When you're sure that the heating season is over, you can save a considerable amount of fuel by having the furnace pilot light turned off. But make a note to be sure to have it re-ignited before you turn the furnace on again next fall.

• • •

Use small, portable appliances -- like electric skillets or toaster ovens -- when you're cooking small quantities of food. They use less energy and cost less to operate than a full size oven.

• • •

Have you checked the wheel alignment on your car recently? It should be checked at least once a year. In addition to being dangerous, improper wheel alignment increases gasoline consumption.

• • •

Now that Spring is on the way, save energy by using an old-fashioned clothesline. Clothes dried outdoors often seem fresher, and you'll be saving the energy used to run your automatic dryer.

• • •

Install a flow restrictor in your shower. It's easy to install and saves water by restricting the flow to 3 or 4 gallons per minute, which is very adequate for showering. Using more hot water than you need really wastes energy and money.

• • •

You can save electricity by allowing dishes to air dry in your dishwasher. After the final rinse cycle, turn off the dishwasher, open the door and let dishes stand until they are drained and dry.

• • •

If you have only a small load of clothes to wash, save energy and water, too, by reducing the water level in your washing machine for that load.

• • •

Don't waste energy on chilling heavy wrapping paper in your freezer. Before placing foods in the freezer make sure that all items are sealed properly, but remove heavy paper.

• • •

Try using clear finish light bulbs rather than frosted bulbs in shaded fixtures where glare from the visible filament won't be a problem. You'll find that you can use somewhat lower wattage clear bulbs and still maintain the same level of illumination.

• • •

Remember to fill clothes dryers, but do not overload them. If you have more clothes to dry than one load can handle, leave small, lightweight items until last. You may be able to dry them, after you turn off the power, with heat retained by the machine from the full load.

• • •

Don't use too much detergent when you are running your washing machine. Follow instructions on the box. Oversudsing makes your machine work harder and use more energy.

• • •

Plan to do as much cooking as possible in the early morning and late evening hours. This will reduce heat build-up in your home during the hottest part of the day, and will also help to shift utility demand to off-peak hours.

• • •

Don't let the engine of your car idle longer than a minute. It takes less gasoline to restart the car than it does to let its engine idle.

• • •

Remember to avoid hot-rod driving and jerky acceleration. Sudden starts and stops can increase fuel consumption by two miles per gallon in city traffic. Drive at a steady speed, and save precious gas.

• • •

As summer approaches, consider the advantages of installing awnings on the windows on the sunny sides of your house. When lowered during the day, awnings can reduce solar heat gain by as much as 80 percent.

Going on a trip over the holiday weekend? Remember that a careful driver may get 50 percent more miles per gallon than a wasteful one. Drive at a steady pace and avoid stop and go traffic.

Observe the 55 miles per hour speed limit while on the highway. Most automobiles get about 20 percent more miles per gallon on the highway at 55 mph than they do at 70 mph.

While driving your car, accelerate smoothly and moderately. Achieve your desired speed quickly, and then keep a steady pressure on the accelerator, just enough to maintain speed.

When you're working in your garden this summer, do not allow gasoline-powered yard equipment to idle for long periods. Turn off the equipment when you finish one job and restart it when you're ready to resume work.

Record your gasoline use, and try to get more miles per gallon out of your car. Don't let your engine idle for more than a minute.

Eliminate unnecessary trips. Can you find one driving trip per week that could be handled by telephone or combined with another trip? If every automobile took just one less 10 mile trip per week, the Nation would save 3 1/2 billion gallons of gas a year, or nearly 5 percent of the total passenger demand for gas.

Share your ride. Join a car pool or van pool. About one third of all private automobile mileage is for commuting to and from work.

Don't let the gas station attendant overfill your tank. Ask him to remove it when the automatic valve closes. This will eliminate any chance of spillage.

Remember to buy power tools with the lowest horsepower adequate for the work you want to do.

Keep cutting edges of tools sharp. A sharp bit or saw cuts more quickly and therefore uses less power. Oil on bits and saws reduces friction and therefore also reduces power required.

Use hand tools, hand lawn mowers, pruners and clippers whenever possible.

If you are considering buying a new appliance, perhaps one with special features, find out how much energy it uses compared with other, perhaps less convenient models. A frost-free refrigerator uses more energy than one you have to defrost manually.

Always turn three-way bulbs down to the lowest lighting level when watching television. You'll reduce the glare on the TV screen and save energy.

Consider fluorescent lighting for the kitchen sink and countertop areas. These lights set under kitchen cabinets or over countertops are pleasant and energy efficient.

You can save some energy that you would use for lighting by decorating with light colors. Remember, light colors for walls, rugs, draperies and upholstery reflect light and therefore reduce the amount of artificial light required.

Try 50 watt reflector floodlights in directional lamps, such as pole or spot lamps. These flood lights provide about the same amount of light as the standard 100 watt bulbs but at half the wattage.

Take showers rather than tub baths, but limit your showering time and check the water flow if you want to save energy. You can save about 5 gallons of hot water every time you substitute a shower for a bath.

Consider installing a flow restrictor in the pipe at the showerhead. This is an inexpensive, easy to install device that can restrict the flow of water to an adequate 3 to 4 gallons per minute. Over a year's time this could save considerable amounts of water and the energy used to produce it.

Never boil water in an open pan. Water will come to a boil faster and use less energy in a kettle or covered pan.

Remember to set your thermostat at 78 degrees. If this temperature raises your home temperature by six degrees, from 72 to 78 degrees, for example, you should be able to save between 12 and 47 percent in cooling costs, depending on where you live.

You'll save money if you'll use a fan rather than air-conditioning when the outside temperature is below 82 degrees. When windows in the house are open, the fan pulls cool air through the house and exhausts warm air through the attic.

Clean or replace air conditioning filters at least once a month. When the filter is dirty, the fan has to run longer to move the same amount of air, and this takes more electricity.

With or without air conditioning in your home, keep out daytime sun with vertical louvers or awnings on the outside of your windows, or draw draperies, blinds, and shades indoors. You can reduce heat gain from the sun by as much as 80 percent this easy way.

You'll save energy required for hot water if you take showers rather than tub baths. When you're showering, you can save the energy needed to iron your clothes if you hang them in the bathroom. The steam can often remove wrinkles for you.

• • •

Try doing laundry in cold water. And don't use too much detergent. Follow the directions on the package. Oversudsing makes your washing machine work harder and wastes energy.

• • •

Remember to clean the lint screen on your clothes dryer. Lint restricts the flow of air in the dryer and requires the machine to use more energy in drying your laundry.

• • •

Be sure to keep your refrigerators and freezers defrosted. This is particularly important during warmer weather. Frost buildup increases the amount of energy needed to keep the engine running. Don't allow frost to build up to more than one-quarter of an inch.

• • •

Try to use energy-intensive appliances such as dishwashers, laundry equipment, and electric ovens during early morning or later evening, which are off-peak times. To meet demand during peak hours, the electric companies often must use less efficient back-up equipment. If more people scheduled household chores during offpeak hours, the utility companies' daily fuel use would be reduced, and the Nation's energy would be conserved.

• • •

If you own a pressure cooker or microwave oven, use it to reduce cooking time. You'll save energy and stay more comfortable by reducing heat build up in the kitchen.

• • •

Save energy by letting dishes air dry. If your dishwasher does not have an automatic air-dry switch, turn off the control knob after the final rinse. Open the door a little to let the dishes dry faster.

• • •

Don't open the oven door to check on foods being cooked. Use a timer or watch the clock. When you open the oven door you waste energy as heat escapes. You also heat the kitchen unnecessarily.

• • •

When you are using your oven, cook as many foods as possible at one time. Prepare dishes that can be stored or frozen for future use. This will save household energy costs and your own energy as well.

If you have accumulated only a few dirty dishes, wash them in a dishpan instead of using your dishwasher. You'll save hot water, and the electricity or gas that the dishwasher would consume.

• • •

Don't let the gas station attendant "top-off" your tank by filling it to the brim after the nozzle's automatic shutoff stops the flow. This often results in overflow and a waste of gasoline. Also, in warmer weather some space should be left in the tank for expansion.

• • •

Plan to share a ride with friends to the beach or the mountains during the summer. You'll have more time to visit, and you'll reduce travel costs and save gasoline.

• • •

When driving your car, remember to use the brakes sparingly. Accelerate briskly, but smoothly. Maintain a steady, light foot on the gas pedal, and you should be able to reduce your need to brake. Good driving practices can save you gasoline and money.

• • •

During the summer, and all year around, it is a good idea to thaw frozen foods in the refrigerator. As the food defrosts it helps to reduce the cooling requirements of the refrigerator's motor, and that saves energy.

• • •

Did you know that pilot lights for gas stove burners and ovens burn about 1/3 of all the gas used for residential cooking? Make sure that your pilot light is properly adjusted--it could be burning more fuel than is necessary.

• • •

Be sure to turn off all appliance when not in use. During hot weather this is particularly important so that power systems are not overtaxed and so that the heat generated by such appliances does not add unnecessarily to air conditioning loads.

• • •

When the outside temperature is 75 degrees or below, save energy by turning off your air conditioning system. Use a fan instead.

• • •

Remember that when driving your car, if you dress appropriately for warmer weather, you'll save some of the gasoline and expense of using the car air conditioning system.

• • •

Drive at a steady speed and save gasoline. On the highway, varying speeds by only 5 miles per hour can cost you about 1.3 miles per gallon. Note that the most efficient speed range is 35 - 45 miles per hour.

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If you use gasoline powered equipment for yard work, such as mowing the lawn, don't let such equipment idle when you're taking a break. Remember to turn it off, even for a short time period. Idling the motor wastes energy.

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Does your car's motor run fast when it's idling? That wastes gasoline. Have the choke checked to see if it needs adjustment.

Save gasoline by shopping as close to home as possible. Also, remember to combine errands for more efficient use of energy and of your time.

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If you're thinking about buying a room air conditioner, consider the advantages of selecting a unit with a higher energy efficiency ratio. The EER number appears on a sticker or tag affixed to the machine. Higher EER ratings can help hold down your electric bills!

During hot weather try serving your family more cold dishes and salads in place of cooked meals. This may be easier on the cook, and your home will stay cooler and more comfortable without heat from the oven. You'll use less cooking and cooling energy, and you'll save money.

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On very warm days, use your draperies and curtains to help keep the heat from the sun out of your house. Draw draperies and curtains across windows during the hottest part of the day. Open them later when the temperature drops.

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When the heating season is over you may want to save gas by turning off your furnace pilot light. If you don't know how to do this yourself, consult your gas company. Be sure to put a reminder to yourself in a prominent place to be sure that the pilot is reignited before you turn on the furnace in the Fall.

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Now that the days are longer you will need less artificial light. Did you know that in just five hours, two 100 watt bulbs use 11,600 British thermal units of energy, or the equivalent of one pound of coal or one half pint of oil? Turn lights on only when you really need them.

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Remember that foods cook more quickly when pots and pans are covered. Water will boil faster in a covered pan. Uncovered utensils consume more cooking energy and heat the kitchen more as well.

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You will be a lot more comfortable during this summer if you dress appropriately for warmer weather. A light weight skirt feels about a degree and a half cooler than light weight slacks. A short sleeved shirt feels about 8/10ths of a degree cooler than a long-sleeved shirt.

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If you're planning to be away on a vacation during the coming months, don't forget that you can save energy at home while you're away. Turn off all lights and air conditioning. And empty the refrigerator, disconnect it from the power outlet, and leave the door ajar.

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Never operate a window or attic fan in an air conditioned area. It will force cool air outside, and waste energy.

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If you have a room air conditioner make sure that the fresh air intake is closed off during the hottest part of the day. Otherwise, you're constantly cooling hot outside air, and that's energy-wasteful and expensive.

Are you planning to remodel your kitchen this Spring? Remember not to build cabinets or counters too close to the refrigerator. If you want the "built-in" look, be sure to leave enough space for air to circulate around the refrigerator. If air flow is restricted, heat can build up and the air compressor must then work harder and longer -- and waste energy!

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Boiling water with least amount of fuel

Model city using no petroleum products

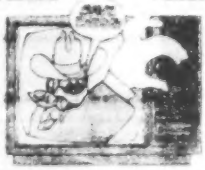
Energy

Learning the Conservation ABCs

More schools are teaching ways to save fuel

The big event of the day for the eighth-grade students at Ken Caryl Junior High School in suburban Denver is the "Great Boil-Over." Under the rules, contestants are pitted against one another to determine who can boil water fastest —with the least amount of fuel. The exercise is part of a growing trend in U.S. elementary and high schools: instruction in the basics of energy conservation. The aim is to prepare students for a world where energy is no longer cheap or plentiful. Teachers explain how students' fuel-using habits touch on the larger issues of dwindling supplies of oil, gas and other fossil fuels and the importance of alternative energy sources.

In the Denver program, one of the nation's most advanced, teachers started from scratch and wrote a textbook with the help of the Colorado office of energy conservation. The course involves 390 students in six Jefferson County schools. Points are made mostly through class activities. A sample: "Catch the Sun," a lab experiment that measures the heating power of solar energy on a thermometer. A key exercise calls for students to record their household energy use—kilowatt-hours of electricity, cubic feet of natural gas—on special grid sheets. In this way they can compare their energy use with the much smaller world average. Most students take to heart what they learn. Diane Molzahn, 13, reports that her family have "cut the use of most small appliances and have begun washing dishes by hand instead of using the machine." Another student, Eric Lamoe, 14, says that, at his urging, his family has weatherstripped the doors and changed many light bulbs to 25 watts. Adds Eric: "I don't use my hair dryer any more, and neither does my brother or my mom. It adds up to quite a bit."



Energy instruction in other cities is generally less formal, though the impact of student thinking has been striking. In the Los Angeles school system, teachers begin focusing on energy at the kindergarten level, urging kids to turn off lights and not to linger in front of an open refrigerator for long, languid looks. Chicago schools have for years been teaching environmental science, with emphasis on energy conservation. Mike Palatnik, a teacher at Sullivan High School, made an intriguing discovery: "Kids want cars and material things, particularly boys. They are often hard to reach. Girls, on the other hand, seem to have more guilt about wasting energy."

Chicago's downtown Metro High School has created a course in energy careers. Students pursue individual projects, such as assessing the effectiveness of the city's fuel use, and are aided by Shaeffer & Roland, an environmental management firm. Says Teacher Frances Vandervoort, grandly: "By 1980 there will be 300,000 jobs in solar energy alone, and we are helping prepare our students for these opportunities." At suburban Evanston Township High School, an architectural drawing program includes the study of solar heating, wind generators and maximum use of insulation. At a recent science fair at Brooklyn's Roy Mann Intermediate School, there was an impressive array of energy projects. One seventh-grade student, Chris Bonagura, 13, built a working model of a solar-heated home. He was inspired when he became cold one night on an environmental field trip. Says he: "I thought about heating and solar energy—no wasted coal or oil or garbage like that, you know. It's just the sun." At Dwight Morrow High School in Englewood, N.J., Mike McGlue, head of the science department, helped set up an energy program. Says he: "We talk about students' homes—insulation, where the house should be placed, what number of B.T.U.s are lost with different types of insulating materials."

The Department of Energy distributes free teaching aids for schools. Among them are an impressive array of questionnaires accompanied by answer sheets. An example: a sheet showing three pictures of homes asks, "What's Wrong Here?" The sketches depict, among other things, open windows in the middle of winter, a running water faucet and one passenger in a car. For small kids, there are wall posters with cartoons showing what should be done to save: drive small cars, observe the 55-m.p.h. limit, keep the home heat below 70° and take showers rather than soaking in a tub full of hot water.

What does all this effort add up to? Dwight Morrow's McGlue put it best: "We hope that the next generation will lead us by the hand to a better understanding of our real energy needs. It's just a matter of transmitting knowledge as best we can as it becomes available." ■